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IMPROVED CONDITIONS IN THE ELECTRICAL INDUSTRY.

Careful inquiry among the leading manufacturers of electrical apparatus indicates that there is an increasing feeling of confidence due to the encouraging prospect of a revival in the demand for this material. The leading houses are receiving a number of inquiries through their branch offices in all sections of the country, and the business thus indicated should aggregate a considerable volume, the stimulus thus effected having a very beneficial influence upon the trade in general. Manufacturers at the present time are keenly alive to every possibility of new business, and we find in every direction a disposition to develop new lines and to meet the demands of the user of electrical apparatus more than half way in the extension of credit and in co-operation with him in the handling of orders of every magnitude.

Just as soon as the danger signals were hoisted last October retrenchment set in. To-day it is a matter of fact that there are not in hand any large accumulations of retail supplies. During the spring there has been very little stocking-up. The disciplinary regulations which have been put in force have improved labor conditions, and in its eagerness to be kept on the pay-rolls labor has become more efficient than for many a day.

Central stations, street railways, telephone and telegraph companies have cut down their operating expenses, but have continued to take on new business. In these fields there has not been the decrease in revenue which has been experienced in other phases of industry. While there may be some complaints that these utilities are not operating up to their capacities, it must be remembered that within the last two years their capacities have been very greatly increased, so that if at the present time a company is operating at only fifty per cent of its capacity, it may be operating at more than double its capacity of a few years ago.

Owing to the fact that, notwithstanding the depression, earnings have held fairly well, with the indication that if the present rate of gain is maintained, the year will close with earnings at least comparable with those of 1907—and that was a record year—there is less timidity on the part of the managements of street railway, central station and telephone and telegraph corporations to place orders for new apparatus and to undertake still greater developments. Within the last few weeks this feeling of confidence has been placed upon a dollars-and-cents basis, the reports from the leading manufacturers of the articles entering into the conduct of this industry showing that the business has been imbued with new life.

AN EXAMPLE OF UNECONOMICAL POWER-PLANT CONSTRUCTION.

Some engineers believe that power-plant design is a matter of opinion. It is, in fact, a matter of experience. Owing to a lack of experience in this particular line such engineers adhere to the unproved opinions of themselves and others, particularly those of the engineer-salesman. To what such "opinions" may lead may be seen from the following:

The design and construction of a somewhat prominent central plant for supplying heat, light and power for manufacturing purposes has recently been closely followed. Before the plans of the substructure and superstructure were completed two tall chimneys had been erected resembling obelisks in a desert. As the buildings were of later design much of the arrangement had to be accommodated to the chimneys already in place. It was the opinion of the engineers in charge that the chimneys rested on hard-pan. However, in this case the settlement of the chimneys was enough to crack the basement walls (one crack being seventeen feet long) and it was later discovered that one of the chimneys was fully a foot out of plumb.

The whole layout of the plant was practically made without any consideration of the scheme of piping. The location of the foundations, one of the most important features in the layout of power plants, was determined from unchecked pencil drawings on cheap sketch paper. The floors were made of concrete, reinforced by rods, which in itself is not good design for power-plant work, and especially as the location of the auxiliary machinery to be carried on the engine-room floor was not determined at this time. Much of the machinery, particularly that for manufacturing purposes, is located on this floor and consequently many holes had to be cut for the necessary pipes. In fact there were so many of these holes, several of which were eighteen inches in diameter, that a pneumatic drill was brought into service to cut them. A seven-and-one-half-foot octagon hole had been provided. However, when the size of the accumulator was later determined this hole had to be enlarged to nine and one-half feet square. Cutting such holes, it will be readily understood, necessitated the cutting of the reinforcement rods.

Probably one of the worst blunders made was in the erecting of the concrete basement walls. Openings were left in the concrete division wall for the piping leading from the boiler room into the generating room before the piping layout was made. Bolts were fixed in the concrete floors for pipe-hangers, and consequently when the piping layout was made the main steam pipe, which is fifteen inches in outside diameter, and the exhaust pipe had to be arranged to suit these hangers.

The boiler units installed, which are of 500 horse-power, are provided with eight-inch steam connections giving a velocity of steam of about 1,800 feet per minute, while the common practice calls for 6,000 feet, so that six-inch pipes would have been ample. The ring system is employed, the pipe being fifteen inches outside diameter, although a twelve-inch pipe, according to common practice, would serve the purpose with much better results, reducing the amount of condensation, occupying less space and being more flexible. Furthermore, the first cost would have been reduced, and at least $2,000 could have been saved on the main steam piping alone if experience had prevailed in the matter of determining the sizes instead of "opinion." The same is true as to all the other piping in the system. The engineers in charge, probably not feeling sufficiently competent, gave out to a contractor the work of designing the layout of the piping with the above result. And there is no uniformity of design in the laying out of the piping system, as there are fourteen-inch high-pressure valves provided with by-passes which in other cases are omitted, whereas the six-inch valves are all so provided. It is common practice to provide all high-pressure valves above ten-inch with by-passes.

While an unusually large amount of time was spent on drawings and specifications for the piping system, many important features were lost sight of and much time was wasted on small details. It is safe to say that there could have been saved in first cost of the complete piping system between three and four thousand dollars out of a total cost of the piping of almost $20,000, and at the same time a better and more economical system would have been secured.

The boiler room is provided with plenty of louvres which, however, are not properly placed. The ventilation in the firing aisle is poor, as the coal bunkers, designed for eighteen-ton capacity per running foot, are carried on girders seven feet nine inches deep. These girders have a span of thirty-two feet and extend down a little below the top of the boilers, cutting off the passage for light and ventilation which is considered so necessary in power-plant practice.

The engine room has two large monitors situated directly above the turbo-generators; in case of sudden rain this might readily be the cause of short-circuits. Since in this case plenty of light is secured from the windows in three sides of the engine room, these monitor windows could have been dispensed with and less expensive and more efficient means for ventilation been provided.

By adopting practically the same type of cooling tower, but set several feet lower, the water of condensation from the condensers could have circulated by gravity and the expensive hot-well tank and additional centrifugal pump for lifting the water to the cooling tower could have been dispensed with.

A very expensive reinforced concrete track scale pit, for weighing and receiving the coal, was built, the design having been complicated to an extreme in order to save a few yards of concrete. If calculation had been made it would have been found that by the use of a few yards more of concrete the design might have been simplified and seven to eight hundred dollars easily saved.

The above are a few of the gross errors made by opinionated designers who, in this case, consumed more than a whole year's time, with a staff of draftsmen, to accomplish what expert power-plant designers would have done more effectually in three to four months, and who would have saved the company some twenty-five to thirty thousand dollars in first cost as well as a very respectable sum in the annual operating expense.

THE INSTITUTE CONVENTION.

The annual convention of the American Institute of Electrical Engineers, which was held at Atlantic City, N. J., last week, was fully as enjoyable and profitable to those attending as had been expected. The weather conditions could hardly have been improved upon, as the sun shone brightly during the entire four days of the convention, yet the temperature was not uncomfortably high. In many ways Atlantic City is an ideal place for such conventions, as the accommodations for visitors are unsurpassed and there are innumerable opportunities for enjoyment besides the main attraction—sea bathing. Under these conditions it was only natural that those who were fortunate enough to be able to go to Atlantic City should have thoroughly enjoyed the four days spent there.

The only criticism which can be made of the convention, and it can hardly be called a criticism, is the amount of work expected of the attending members. It seems to be forgotten that the main object of the convention is the discussion of papers rather than their mere presentation, but this end is always defeated when the programme is crowded; and the better and more interesting the papers, the more disappointing is the result. Another unfortunate result of the plan which crowds the convention days with business sessions is the little time left to the members to become personally acquainted. To many Institute members the annual convention is the only time during the year when they can mingle with many old friends and make more new ones, but when the mornings and afternoons are both taken up with long sessions, leaving hardly time enough in between for lunch, one is more inclined in the evening to drift off into some simple amusement rather than talk shop with his brother engineers.

Various remedies can be suggested for this evil, though not any one of them is itself free from objections. The simplest plan would be to cut down the number of papers, but when there is such a large number of good papers sent in, the selection becomes a difficult and delicate task. No one side must be given preference over any other, and all the different branches of the profession expect recognition. Naturally, with these requirements before it, the Papers Committee is only too likely to err in preparing too full a programme, and the result is the worse, the better the papers. One good paper at the beginning of a three hours' session can easily provoke discussion enough to fill profitably the entire time; consequently the following papers provoke little or no discussion, as those to whom the topic is interesting are either tired and indifferent or hesitate to prolong the session, not only by the time which they themselves would use, but frequently because the man who has something worth saying hesitates to say it lest he start the discussion in a new direction. It is true the time allowed for discussion is largely in the hands of the presiding officer, but when the latter asserts his authority in order to give each of the papers, or topics, its proper portion of the time, the discussions naturally become perfunctory and lacking in value and interest.

Another plan would be to hold parallel sessions which would be devoted to subjects but little related. To those who are specialists or who are interested in but one or two branches of the electrical industry this scheme would be quite satisfactory. On the other hand, there are a great many members, besides those who are teaching, who are interested in various and unrelated topics and who would necessarily feel that they had lost something if two important papers should be taken up by two sessions at the same time.

Still a third plan would be to hold at least two general meetings of the Institute during the year. Each of these might be limited to the consideration of certain topics, so that the member who could attend but one meeting during the year would be able to select that most profitable to him. This plan also has its objections, as it is probable that there would be fewer attending each meeting than now attend the annual convention, although one of the main objects of a convention is to bring all the members of the Institute together irrespective of their special lines of work, and any plan that would interfere with this object should have very marked advantages in other ways to lead to its consideration.

The sessions of the second day of the convention, which are reported in this issue, illustrated very well the objections to the present system. The morning session had three papers dealing with transmission line troubles, while it is well known that a single paper touching upon the topic generally classified as "lightning" in Doctor Steinmetz's use of the term, is sufficient to provoke three or four hours of discussion. There was in addition a most interesting engineering paper dealing with an important transmission system which would have called for a much more general expression of views had there been sufficient time; and there was still a fifth paper which, for the same reason, received but slight attention. Naturally, with this programme before it, the morning session considerably overran the allotted time. The programme for the evening session contained but three papers, all of them, however, of unusual interest and importance. The first to be presented dealt with some interesting high-voltage experiments and would alone have proved sufficient for the session, since its discussion took up the greater part of the evening, but the other two papers were not less important, as one dealt with the design of transmission lines and the other was a tentative specification for testing high-voltage line insulators. Under the conditions, however, they could not be given the time which they deserved. It is greatly to be hoped that some plan for alleviating the conditions will be arranged. Matters were much improved at the present convention by having all of the papers printed and distributed in advance, and in many cases the author had carefully prepared abstracts, thus insuring a brief but satisfactory presentation of his paper in the time allotted to him. It would be well for those who intend to take part in the discussions to prepare their remarks in the same way. They would then be sure of saying what they intend to say, which is not always the case when they speak without notes; and much time would be saved.

Annual Convention of the American Institute of Electrical Engineers.

Report of the Discussion on Papers Dealing with Transmission Problems.

THE twenty-fifth annual convention of the American Institute of Electrical Engineers was opened at Atlantic City, N. J., on Monday morning, June 29, at 9.30 o'clock by President H. G. Stott. The report of the first day's sessions was given in the issue of the ELECTRICAL REVIEW for July 4.

The third session was opened at 9.30 A. M., Tuesday, June 30, at the Hotel Traymore, by President Stott, and three papers dealing with transmission line troubles were taken up.

E. E. F. Creighton, in a paper on "Measurements of Lightning, Aluminum Lightning Arresters, Earth Resistances, Cement Resistances and Kindred Tests," gives the results of the past year's investigations of lightning and the operation of lightning arresters. For this purpose two lines were chosen, well up in the Rocky Mountains of Colorado, and new types of apparatus for measuring the various quantities involved in lightning discharge were developed and installed. These are described in the paper, and the methods in which they were used are discussed and a good deal of data collected during the two years of study given. The paper is divided into six parts. The first discusses the duration of lightning and describes the apparatus devised for measuring this. The records were made on a rotating sensitive film. In this section, also, the methods employed for determining the flow of current are described. By placing a group of graded fuses in the discharging circuit limiting values may be determined, and when the frequency and duration and other constants of the circuit are known the quantity of discharge may be estimated. The second division of the paper discusses the frequency of the discharge. For measuring this resonators were employed consisting of coils of German silver wire such as are used for the same purpose in wireless telegraphy. The third section of the paper discusses the experience on the two transmission lines under observation. Records were kept by means of a moving tape placed in the discharge gaps. It is suggested that since the aluminum arrester is designed to operate continuously for half an hour or more, it is feasible to attach an alarm to these arresters which will signal to the operator at the station when a discharge is taking place so that he may take precautions to clear the line should the trouble continue. On two occasions it was found that choke-coils were beneficial. On several occasions one phase of a system became grounded and in each case gave rise to vicious surges on the lines. To prevent such surges from causing damage is the most difficult problem in lightning protection. The various factors influencing the general design of the aluminum-cell arrester are discussed in the next section of the paper. One feature is the disappearance of resistance in the arrester when a discharge takes place. Another is the continual dissolution of the metal in the electrolyte. This is controlled by the choice of the electrolyte. A third feature is the ability to endure continual discharges. A properly designed arrester should have a life of several years. The design is, of course, largely influenced by the cost of the arrester. The results of an investigation of the resistance of earth connections is given in the fifth section of the paper. It was found that these could be considerably improved by saturating the ground with brine. The concluding part of this paper is a report on cement as a resister, prepared by R. H. Marvin. The specific resistance of different mixtures is from one to 3,000 ohms when wet; when dry, it is over a megohm; when again wet, the resistance falls to approximately its original value.

Ernest J. Berg presented a paper entitled "Tests with Arcing Grounds and Connections." This described a number of tests made on a twenty-five-cycle, 33,000-volt system supplied from a three-phase turbo-generator. The effects of grounding the system in various ways were examined, but no mathematical expressions for these were deduced. In one of these tests the high-potential side of a step-down transformer was grounded at both terminals and coupled with the high-potential side of a step-up transformer through a ground connection on one side and a spark-gap on the other. It was found that with this arrangement, when a discharge was taking place, the strains on the end coils of the step-down transformer were ten times normal at one end while apparently normal at the other. When the ground connection on the step-up transformer was removed, the strains were very much reduced. In another test an arcing ground was made at the terminal of the step-down transformer. It was found that the strains on the end turns at the grounded terminal were fifteen times normal. No abnormal strains were noticed at the other terminal of this transformer. Three transformers were then connected up in delta and an arcing ground established at one apex. It was found that the striking distance across the two transformers nearest to the ground was nearly double the normal, while that across the transformer opposed to the ground was twenty per cent above normal. Renewing one of the transformers so as to give an open delta grounded at one end produced very high stresses in the two transformers. In one it was fifty-five per cent above the normal; in the other, 2.2 times the normal. Grounding the middle line of the two transformers developed a stress in them of over two times the normal, and in each case the striking distance across the end coils was from fifteen to twenty times the normal. Placing an inductance in the grounding connection did not seem to affect the results, even though the reactance was twenty-five per cent of that of the transformer. Various methods of relieving these strains were investigated. One consisted in connecting condensers across the end turns, resistances being introduced in these shunts. This simply transferred the stress from the end coil to the next one. Loading the transformers did not materially affect the results. The author concludes that with increasing line voltages it will probably become desirable to resort to some new methods of protecting the windings of transformers and other apparatus connecting the high-potential lines. It is suggested that this might be accomplished by connecting a series of electrolytic cells in shunt with the end turns. He points out that in his experiments there were no transmission lines between the transformers, so that the results do not represent what would actually occur in a transmission system.

Percy H. Thomas, in a paper entitled "Critical Study of Lightning Rods on Taylor's Falls Transmission Line," discussed the two papers read by J. F. Vaughan and N. J. Neall at the May

meeting of the American Institute of Electrical Engineers. These records are gone into in some detail and the lessons taught by them are summarized. They show that the extent of a lightning disturbance is readily extended over more than a mile or two and that it may charge up the line and send waves of static in both directions which are able to pass many miles and still cause arresters to discharge. It is thought that little protection is obtained from lightning rods located beside the line, and whether the protection is obtained from overhead or grounded wires or not depends entirely upon the arrangement of the wires and the frequency of grounding. Station arresters of the best types should, in the absence of severe discharges close to the station, protect adequately the station apparatus if they be properly insulated. Horn arresters, as installed, are not non-arcing without adequate series resistance, and can be relied upon occasionally to shut down the plant. Both the electrolytic and the low-equivalent arresters showed themselves properly non-arcing and caused no trouble on this score.

The discussion was opened by the reading, by P. H. Thomas, of a communication from J. F. Vaughan discussing Mr. Thomas's paper. Mr. Vaughan said there was little evidence of there being much energy in a lightning discharge, provided the successive discharges succeeded one another frequently. If one accepted the release of the bound-charge explanation offered by Mr. Thomas it would be necessary to modify our ideas concerning the effects of lightning. As indicating the value of the grounded wire, the experience with a three-phase system arranged in the usual triangular manner offered some evidence. It was found that with such an arrangement the wire facing the direction in which a storm was coming was the one to suffer first; while, as the storm passed over the transmission line, the wire at the top showed the greatest activity. In his investigations he had not noticed any direct strokes.

Dr. C. P. Steinmetz expressed his appreciation of the value of these painstaking investigations of lightning troubles. The study of transient phenomena such as lightning is exceedingly valuable, and it seems likely that before long we will be as familiar with such phenomena and be as able to predetermine their effects as we can now for ordinary alternating currents. Coming to the ground wire as a means of protection, with the exception of a few "doubting Thomases" this is now generally admitted to be the most efficacious protection. Dr. Steinmetz does not agree with Mr. Thomas's explanation of the Taylor's Falls trouble. The latter says the cause of the trouble is not a direct stroke, but the releasing of a bound charge, and Dr. Steinmetz can not see the difference between the two. Regarding the use of tell-tale papers, it would be well to fireproof these by the use of some such material as tungstate of sodium, which would prevent combustion after a discharge. This treatment in no way affects the paper nor changes its behavior with regard to the discharge through it. It simply prevents its continuing to burn.

P. M. Lincoln agreed with Dr. Steinmetz concerning the value of the grounded wire, and took issue with Mr. Thomas in his interpretation of the records given in Mr. Vaughan's previous Institute paper on the Taylor's Falls experiments.

Dr. A. E. Kennelly said the construction of an overhead line was important on account of the change in construction involved when such is used. As to its benefits, the experience of half a century in telegraph operation seemed to be of value. Although the conditions of operation and the troubles resulting from lightning on telegraph systems were different from those on transmission lines, it still was significant that the lower telegraph wires always escaped during thunder-storms. This had led to the use of a short grounded wire run up each pole as a means of protection. Nevertheless, it is not safe to hope for perfect freedom from trouble, nor is it time yet to form a definite opinion of the cause of the disturbances. There are several possible causes, and our minds should be held open until more definite and complete knowledge is obtained. There is one cause not usually recognized. This is the electromagnetic waves set up by a distant lightning discharge.

J. B. Taylor objected to the use of the term "lightning" in a broad sense, a use attributed to Dr. Steinmetz. There seemed to him no reason why the old meaning of the term should be changed. Regarding the frequency of the discharges as found in Mr. Creighton's investigation, he wished to know whether the lower frequency was not merely the natural discharge frequency of the line. Mr. Berg's experiments were valuable, but, unfortunately, no explanations of the effects there described were attempted.

Mr. Taylor also asked what authority Mr. Thomas had for his use of the term "static" in a new sense, particularly since the electrical charge referred to was one in motion.

R. H. Marriott described some experiences which he had had with electrical disturbances on a wireless telegraph antenna. Three kinds of disturbances were noticed —electromagnetic waves, such as referred to by Dr. Kennelly, produced by a distant lightning discharge; a direct discharge to the antenna, and disturbances produced by wind friction on the wires.

D. B. Rushmore cautioned the Institute against drawing conclusions from insufficient knowledge. More complete investigations must be made. In his opinion the application of the oscillograph to the study of lightning phenomena was the first real step which had been made in this direction. He did not think that a burned hole in a piece of paper could be taken as real evidence. It is only a "may be." The ground wire is generally accepted as good protection, but it is hard to prove directly its value. He thought the proper method of protecting a system is to install lightning arresters to protect the station apparatus, but not the line. To protect the latter an overhead ground wire or lightning rods should be used, and better line insulators. We are now at the point where we are able to protect the station apparatus against lightning troubles, so that the problem is being transferred from the station to the line, and here the study of line insulation is the most important question.

J. W. Fraser explained briefly the experiences of the Southern Power Company in the use of lightning arresters for protecting its transmission lines. Both multigap arresters and low-equivalent arresters are employed. Last fall a number of aluminum arresters were put in. Since then several severe storms have occurred, and the latter arresters seem certainly to be doing good work. They handled three severe grounds without damage. During last season the Southern Power Company lost but one transformer, and that one had been damaged somewhat during erection. There were a few broken bushings, indicating that a better passage to ground was necessary at certain points.

L. W. Waters took up Mr. Berg's paper, saying that if the potential at the end turns of a transformer increased toward the end, the excess potential of the last turn might easily be 100 times the normal at times of lightning troubles. If taps are introduced these simply add danger points. The only solution of the problem thus confronted is extra insulation of the end turns or the use of choke-coils. On

account of the expense of the former method the latter is the only one commercial. He thought that probably the conditions are not quite so serious as Mr. Berg's paper makes out, as records of performance do not indicate that the end turns are more liable to trouble than intermediate turns.

William McClellan said that the telltale paper records should be taken merely as corroborative evidence. The method employed by Mr. Creighton is good as giving direct evidence. There are two parts to this problem—the protection of the station and the protection of the line. We are able now to protect the former, and the question is merely the amount and kind of protection to be adopted. The great problem, therefore, is to protect the line. It is impossible to do this with the station arresters, and the best solution seems to be the grounded wire.

F. Osgood asked what the limits of the disturbing influences during lightning troubles are. He also wished to know what is the value of serving the wire at the insulators so as to prevent breakage due to arcing.

D. C. Jackson thought that not enough work had yet been done in investigating lightning troubles to lead to entirely satisfactory conclusions. To-day it is merely a question of how much money a system can afford to spend to protect its lines. He is looking forward to better results in the future.

Dr. Steinmetz, replying to the question asked by Mr. Osgood, prompted by a conclusion drawn in Mr. Thomas's paper, said that that conclusion must not be accepted too literally. The statement that the effect of discharge is limited to only half a mile is not quite true, since even though the direct discharge does escape to ground within this distance, the secondary effects, such as surges, may extend over the entire line. He did not agree with Mr. Waters's statement that there was no evidence of abnormal stress on the end turns of transformers, because the continued breakdown of the end turns had forced the manufacturers to increase the insulation of these turns. Now the fact that there is no more trouble there than at other turns is merely an indication of the proper distribution of insulation and of correct design. Very high-potential transformers, however, still give trouble there.

In closing the discussion on his paper Mr. Creighton said that there were no dynamic currents on the line when his records were taken. He did not think that overhead grounded wires afforded complete protection, but they bring the potential of the system during the disturbance to a value which the line can stand. Storms vary considerably, but are largely influenced by the country. Regarding the broad use of the term "lightning" he placed the responsibility on Dr. Steinmetz, but thought this use good. As to the frequency of lightning discharges, it is hard to say. These may have almost any frequency, as high even as a million cycles per second, or no frequency at all, being simply a single discharge. He agreed with Mr. Berg that the greatest problem is to protect the system against internal surges. One important question is how many stations must be fitted with arresters to protect them all against these troubles.

Mr. Berg, replying to Mr. Taylor's criticism, said that no theory of the arcing ground can yet be given because the knowledge is incomplete. He found that during these troubles the end turns of the transformers are heated, indicating the flow of a heavy current there. Choking-coils are not completely effective for protecting transformers, and the General Electric Company insulates the end turns of its transformers for from 100 to 200 times the normal voltage.

P. H. Thomas said that caution should be used in studying Mr. Berg's results. His records are given in the distances jumped by the sparks, and not in the actual potential of the discharge. He himself objects to the wide use of the term "lightning," but thinks the term "static," as used by himself, fits the case exactly. His views on the value of the grounded wire seem to be misunderstood. He thinks that this does give the best protection, but his criticism of Mr. Vaughan's conclusions was that the evidence which the latter gave does not show that the grounded wires installed on the Taylor's Falls transmission lines gave the protection attributed to them. In his opinion there is a difference between a direct stroke and the release of a bound charge, and the means for handling the two disturbances should be different. The thing is to determine which of all the troubles is the damaging one. That can then be taken care of and the others let go. Replying to Mr. Osgood's question, he said that the effect of the direct discharge is limited to a comparatively short part of the line, but there may be a series of discharges taking place within one neighborhood. He differed with those who objected to the drawing of inferences from experiments, even when incomplete. In his opinion this is the only way in which to advance rapidly.

J. W. Fraser read a paper on "Some Engineering Features of the Southern Power Company's System." This calls attention to the large number of cotton mills situated in North and South Carolina within transmitting distance of certain large water powers. The opportunity thus offered has been seized by the Southern Power Company, which has secured ten water powers aggregating not less than 150,000 horse-power. It is estimated that the mills lying within the district of this company use approximately 200,000 horse-power, which costs them to produce on an average about $34 a year. In one or two cases the cost had been reduced to $30. Mr. Fraser then discusses the system selected by the Southern Power Company. The original plant on the Catawba River, with an output of 10,000 horse-power, was operating at sixty cycles, and a large number of the motors in use in the mills were, of course, for the same frequency. While a certain economy might have resulted from the selection of a different frequency, it was thought that, on the whole, the most economical solution would be to retain the old frequency. The voltage selected was 44,000, which was sufficiently high for the district covered, and was less expensive to install than a higher potential. The line construction, station and substation equipments are described and the reasons for installing a reserve steam station are explained. It was found at one of the plants that the minimum power was 16,000 kilowatts and that there was an increase of 2,000 kilowatts. If secondary power were to be developed for eight months, the total output could be 24,000 kilowatts. It is a question how much of this secondary power can be developed economically in a steam plant. By charging this power with the entire cost of the steam equipment, it was found that the maximum profit would be made when 2,200 kilowatts in secondary power were developed, but since the steam plant really serves as a reserve for the hydraulic system, it seems only fair to charge the latter with the cost of this reserve and to charge against the secondary power only the actual cost of producing it. On this basis it would be profitable to install a secondary station with an output of 5,500 kilowatts. For these reasons it has been decided to install an auxiliary plant to develop fifty per cent of the primary power.

The discussion was opened by J. H. Finney, who directed attention to the ex-

cellent constructive work being done by the Southern Power Company. The character of the load there makes reliability very important, and for this reason only conservative construction is adopted. A high character of work has been followed throughout the entire installation, and he believes that the system as a whole is as creditable as any in the country.

D. B. Rushmore also praised the character of the work being done by the Southern Power Company, which, he said, was unusually creditable. The 44,000 volts adopted as a maximum there was conservative when first selected, and the importance of the system did not permit any risk to be taken. He thinks that at present there is no justification for a good many of the high potentials which are being adopted. He suggested that multiples of 1,100 volts should be taken as standards, and gave the following list of suitable values: 6,600, 11,000, 22,000, 33,000, 44,000, 66,000, 88,000, 110,000 and possibly 165,000. He believed, however, that to-day there is no reason for anything less than 110,000, except for very conservative systems. The 88,000 might be left out. The Southern Power Company's system has been designed for at least 66,000 volts, so that for a 44,000-volt system the factor of safety is unusually high. There is to-day no reason for using a high-tension delta-connected system, because such a system can not operate with one wire down nor with one transformer cut out.

P. M. Lincoln said that while standardization before adoption is advisable, it would hardly be wise at this time to drop 88,000 volts as a proper transmission potential, because there are now a number of systems going into operation which have adopted this voltage. The selection of a delta or Y-connected system depends upon whether it is intended to operate with a grounded neutral or not.

W. S. Lee, Jr., said that another condition had arisen which might alter the Southern Power Company's decision regarding the development of secondary power. There are a number of cotton mills having highly efficient steam plants, but which would use electric power for six months if they could thereby effect a saving. Hence the company is planning to install sufficient equipment to supply this demand during the months of high water. He said also that in the selection of the voltage of the Southern Power Company the company had in anticipation the use of 88,000 volts later on, and for this reason the insulation of the lines had been particularly cared for. Replying to a question regarding the simplicity of the wiring of one of the generating stations, Mr. Lee said that there were to be three plants in that immediate neighborhood for which there would be but one large complete switching station.

Dr. Steinmetz commended the conservative selection of potential and of line construction adopted by the Southern Power Company. He said that the great results in electrical development which had been accomplished in the South were remarkable. It is noteworthy that the conditions existing there are very different from those in the West. On the Pacific Coast cheap power is very important. In the South there are many efficient steam plants with which the transmission plants must compete, and the character of the load, which is mainly cotton factories, is such that reliability is absolutely essential.

Austin Burt read a paper on "Three-Phase Power Factor." According to the commonly accepted definition of power-factor as the ratio of true power to volt-amperes, there is no single factor which will exactly express such a physical relation in a delta-connected unsymmetrical three-phase system. It is possible, however, to determine by practical methods the weighted mean of the three power-factors of the single-phase pairs of such a three-phase system and to express that value by a single factor. The power-factor of a system may be taken as the cosine of the angle whose tangent is the ratio between the wattless ampere-volts and the energy ampere-volts. The ratio of the total energy-ampere volts and the total wattless ampere-volts in a three-phase system gives a value which is the weighted mean of the similar ratios of the several single-phase pairs. The cosine of the angle whose tangent is this mean ratio may be taken as the mean power-factor of the system. The author then derives the expressions referred to and shows how a polyphase wattmeter may be utilized for measuring the quantities necessary to give the desired ratio by disconnecting first one of the pressure wires and then the other.

C. A. Adams gave a simple non-analytical method of proving that two wattmeters may be employed for measuring the true power of a three-phase system. This conclusion is reached by treating one of the wires as a common return for the other two, considering the whole system as a two-phase system without respect to the difference in phase displacement. He asked whether his solution were not rigorously true.

Dr. F. Bedell said that the proof was rigorous, and had been given by A. Blondel in his paper read before the International Electrical Congress at Chicago, in 1893.

This completed the morning session, which was then adjourned.

TUESDAY EVENING SESSION.

The Tuesday evening session was called to order by President Stott at 8 o'clock, and three papers dealing with high-potential problems were taken up.

Ralph D. Mershon, in a paper entitled "High-Voltage Measurements at Niagara," described the results of tests on an experimental line which had been carried out more or less continually from 1903 to 1907. An experimental line having a total length of 2,000 feet was erected, supported on wooden poles 140 feet apart. The wires were supported first on insulators and later on paraffin cords attached to the insulators in order to eliminate effects of insulator leakage. In addition to the longer line, a short line, a few feet in length only, built up of cross-arms, pins and insulators, was constructed so as to enable the insulator losses to be studied without bringing in losses through the air. Aluminum conductors of various sizes and one copper conductor were tested. The apparatus and methods of measuring the losses are described, the usual method being to balance the two transformer losses against each other, thus enabling the loss taking place, due to the line only, to be measured directly. The general conclusions deduced from this investigation are: With a given conductor at a given spacing, under given atmospheric conditions, there is a certain voltage or critical point at which a very appreciable loss begins to occur through the atmosphere. There may or may not be a loss below this critical point, depending upon the atmospheric conditions. Floating particles in the atmosphere, whether of moisture or solid, promote such loss, and also increase the loss above the critical point. This critical point corresponds to a partial breakdown of the dielectric and coincides with the voltage at which luminosity or hissing of the conductors begins. It depends upon the maximum value of the electromotive-force wave and the distance between conductors. It is really fixed by the potential gradient at some point in the atmosphere. There is a loss over insulators which is affected by the moisture conditions of the atmosphere. The variations in the atmospheric and the insulator loss, due to atmospheric condi-

tions, bear a definite relation to the product obtained by multiplying the vapor pressure by the relative humidity. So far as is at present known, this relation is empiric. The loss over insulators during a fog is higher than in dry air or during a heavy rain. The smoother the surface of the conductor the less the loss, while stranding conductors decreases the loss, due to the increased equivalent diameter of the conductor. Weathering of conductors does not apparently affect the critical point. This point is the same for copper and for aluminum. Anything which increases the charging current of an insulator increases the loss of an insulator, and this loss is greater when wooden pins are used than when the pins are of metal because of the greater resistance of the wooden pin. These losses decrease with the frequency, but the law of decrease is not yet known. Neither the critical point nor the loss between cables is affected by variation in the distance of the cables from the ground.

Following the presentation of this paper, Dr. Samuel Sheldon, in an appreciative address, presented, on behalf of the board of directors of the Institute, engrossed resolutions to Charles F. Scott in acknowledgment of the work which Mr. Scott had done in securing Mr. Carnegie's gift of the Engineering Societies Building and also for Mr. Scott's valuable work as one of the Institute's trustees of the United Engineering Society.

Mr. Scott was deeply touched by this tribute and appreciation, and expressed his feelings warmly.

The discussion on Mr. Mershon's paper was opened by the reading by P. H. Thomas of a communication from H. L. Doherty which discussed the great value of such high-voltage studies.

Dr. Elihu Thomson then took up Mr. Mershon's conclusions *seriatim*. The first conclusion that there is a certain critical voltage is well known. The second is somewhat remarkable, as this states that there may be a loss below the critical voltage depending upon the weather, though there is no visible indication of such loss. The third conclusion, which states that particles in the atmosphere may produce such a loss, is perfectly logical. The effect of water vapor in producing a loss below the critical point may be explained by the fact that water vapor just above the condensation point is not a true gas. There are then some particles of water in the liquid condition. This view brings conclusions 3 and 4 together, and from this conclusion 5, which states that the presence of moisture affects the amount of loss above the critical voltage, follows logically. That the presence of moisture and other particles in the atmosphere affects the position of the critical point is explained by the fact that such particles extend the influence of the conductor.

The next five conclusions, which state that the critical point corresponds to a partial breakdown of the dielectric and coincides with the voltage at which luminosity begins; that this point depends upon the maximum value of the electromotive force; that it depends upon the distance between the conductors and their diameter, and that there is a loss at the insulators which is affected by the atmosphere, are all admitted. Mr. Mershon had apparently found a law connecting atmospheric loss with the product of the vapor pressure by the relative humidity. This is natural, since the quantity of moisture and its condition are both concerned. The greater loss due to fog, as compared with rain, may be because in the former case the entire insulator is covered with water. The conclusion that the smoother the surface of the conductor the less the loss seems logical, but it does not agree with the next two conclusions, which state that the use of a standard conductor of equivalent diameter reduces the loss. The weathering of aluminum conductors would not be expected to increase the loss, and it is also to be expected that this loss would be independent of the material of which the conductor is made. That the increase in the charging current of the insulator increases the loss is natural. The same is true of the conclusion that this loss decreases with the frequency. The fact that the distance from the ground does not seem to affect the loss may be because this distance is relatively very much greater than the distance between the wires.

Dr. Samuel Sheldon called attention to the study of the atmosphere which has been made by Professor Carl Barus, of Brown University. Investigations have been made at Providence, R. I., and at Block Island. He has always found that ions are present in the atmosphere at both places. Dr. Sheldon explained Professor C. T. R. Wilson's idea of how ionization takes place. It is due to the collision of a rapidly moving ion with a molecule. This collision splits another ion off the molecule, which, in its turn, may cause ionization of a second molecule. The effect, when once started, spreads rapidly like a conflagration. Hence the comparatively sharply defined critical voltage.

Henry Floy discussed the early experiments of Professor H. J. Ryan, on atmospheric losses, and said it is probable that the different values of the critical voltages as found by Ralph D. Mershon and Professor Ryan were due to the different methods of determination. Professor Ryan had depended upon visual observations, while Mr. Mershon had used instruments.

Dr. Steinmetz does not admit that the critical potential indicates a sudden change. The change must be gradual. The discharge would probably be started at the kinks in the wire, where brush discharges will arise. They do not represent the true critical potential of the wire. It is hard to get accurate results. He suggested that if Mr. Mershon would plot his results on logarithmic co-ordinates, thus getting straight lines, instead of the logarithmic curves he apparently obtains, that it would be much easier to extend these lines, and thus obtain the critical value accurately. The results given in the paper show that there is a loss, but more work must be done before its value can be known accurately.

P. H. Thomas said that at the present time these atmospheric losses are negligible from a commercial point of view. He suggested also that a quadrant electrometer might be used advantageously for measuring the energy of these losses, since but little energy is consumed in this device. He asked for data indicating the actual atmospheric loss during rain.

P. M. Lincoln pointed out the fact that the experiments had been conducted on a single-phase line, and since the relative potential of the line to ground of a three-phase system would be different, the results might not be directly applicable to the latter.

C. F. Scott said that laboratory experiments frequently failed to give results applicable to outside conditions. This atmospheric loss determines the limit of potential which may be employed for power transmission, and he asked how the limits as found by Mr. Mershon in his recent investigation agreed with those which the latter had assumed in an earlier Institute paper, in which the statement was made that the economical size of conductor for any length of transmission and any possible potential would bring the system below the critical potential.

P. N. Nunn thought that the subject

was more of scientific interest in its present form than of practical value. What is needed on a transmission system before all else is reliability. The insulation of a system must be considered as a whole, and the loss as due to its weakest links. He gave briefly an account of a number of systems with which he had been connected, which had given various degrees of satisfaction, and not always in proportion to the amount of protection or the expensiveness of the installation employed. The best lines have frequently given trouble, and the cheapest ones have been immune from it. Why, he could not say.

Dr. Elihu Thomson questioned the accuracy of the statement that the increase of loss due to vapor in the atmosphere is the same for the same vapor product, no matter what the size of conductor or what the spacing between conductors.

In closing the discussion Mr. Mershon said that undoubtedly Professor Ryan's high values for the critical potential were due to his method of determination. The latter depended upon the appearance of luminosity. Referring to Dr. Steinmetz's criticism, he said that even though the wire might have been kinked, the conditions obtaining were those of actual construction. He questioned whether Mr. Thomas's suggestion that a quadrant electrometer be used could be adopted, because of the loss taking place in the wire employed for splitting the potential. Readings of atmospheric loss during rain had been taken, but no consistent values had been obtained. The behavior then resembled that during a snow-storm. Mr. Lincoln's point regarding the difference between a single-phase and a three-phase system with respect to the ground was good, but this point had not been taken up, and nothing had been done as yet to determine the losses of a three-phase system.

D. R. Scholes presented a paper entitled "Fundamental Considerations Governing the Design of Transmission Line Structures." Before a tower or pole for a given transmission line can be designed, some conclusion regarding the loads to be borne must be reached. Since the towers now in use for transmission lines resemble closely windmill towers, it seems that the best guide in selecting figures to represent the problem of extreme load conditions may be gathered from a study of such structures, as they are the result of many years' experience. The various factors then affecting the strains on the towers, such as wind, sleet, low temperature and accidents due to breaking cables, etc., are considered. The author suggests that towers be designed to resist a wind pressure of forty pounds per square foot, with a factor of safety from one and one-half to two. The actual value of this factor is to be determined by experiment, and the method suggested is the erection of an experimental span as near as possible to a weather bureau station, provision being made to measure the stress. The figure of thirty pounds per square foot is commonly used in bridge calculations, but it is unsafe to assume this in localities where high winds prevail, and when it is used a factor of safety of two should be adopted. It is suggested that the structure should provide for a coating of sleet at least half an inch thick, a factor of safety of two being employed in calculating the ultimate strength of the conductor to carry this load. To insure the cross-arms against breaking, should a cable give way, it is suggested that the arms should be tested to loads equal to one and one-quarter times the elastic limit of the conductor if on pin insulators, and one and one-half times the elastic limit of the conductor if on suspension insulators. In developing the design of the foundation for a given line, tests should always be made to determine the holding power, density, etc., of the soil so that the strength of the foundation will be known as accurately as the strengths of the other parts of the line.

A communication from N. J. Neall was read by Mr. Thomas, which criticized some of the suggestions made by Mr. Scholes, and suggested that more conservative figures would be better, and that a factor of safety of two should be the least employed at any point.

C. E. Skinner presented a paper on "The Testing of High-Voltage Line Insulators," in which a specification is proposed as standard for the testing of high-voltage line insulators. This specification was prepared by request of the High-Tension Transmission Committee of the Institute and it represents, as far as possible, the harmonized information obtained from different sources, and not Mr. Skinner's personal opinion. The specification is divided into three parts: Routine tests, such as inspection, dielectric tests; design tests, for determining the mechanical strength, whether the insulator will be able to withstand its full potential, rain tests and dew tests, etc., and, finally, instructions for carrying out the various required tests. Some of the requirements of these tests, such as the rain test, are more severe than would ever be experienced in practice except under the most unusual conditions.

A communication by N. J. Neall, discussing this paper, was read, in which more severe tests are urged. At least three times the normal potential should be applied to every insulator. Objection is also raised to the suggested method of making the rain test. Mr. Skinner proposes placing the insulator at an angle of forty-five degrees and allowing the water spray to fall vertically. Mr. Neall contends this will not represent the actual conditions on account of electrostatic and gravitational forces.

P. H. Thomas said that insulators should be tested by means of a spark-gap so as to produce a high frequency, and asked what provision has been made for testing at different frequencies.

Mr. Mershon approved the use of the vertical spray with inclined insulator because of the difficulty of accurately obtaining a specified spray at an angle. There is also a good deal of trouble in finding exactly what the spray shall be. He thought that the amount of precipitation recommended was too small. That usually required is one inch per minute, and the records of the Weather Bureau show that occasionally 0.8 inch falls during an actual rainstorm.

Dr. C. H. Sharp described a spray which is used abroad, and which he purposes using in this country for testing insulators. This consists of a cylindrical tank, in the bottom of which are a number of small tubes, each plugged with asbestos wool or some similar material. By applying air pressure to this tank any rate of precipitation desired may be obtained, while this may easily be measured by means of the gauge glass on the tank.

E. M. Hewlett suggested that a steam test might be better than a rain test.

Dr. Steinmetz suggested that all insulators should be submerged for one week before applying the test. This would allow any absorption of moisture due to the appearance of hair cracks in the glaze to take place. Such absorption will, of course, take place after the insulator has been installed. He did not think it was advisable to test any insulator at less than twice the normal potential.

In closing the discussion Mr. Skinner said that in his opinion a dew test will be more severe than a rain test, and much easier to reproduce. He did not think that accurate results could be obtained by blowing the spray against the insulator. The specifications which he had proposed were intended to indicate what a performance test should be and to draw out further information.

The session was then adjourned.

(To be concluded.)

Street Railway Association of the State of New York.

Twenty-sixth Annual Meeting, Held at Niagara Falls, Ontario, June 30 and July 1.

THE twenty-sixth annual meeting of the Street Railway Association of the State of New York was held at the Clifton Hotel, Niagara Falls, Ontario, June 30 and July 1. President T. W. Wilson, general manager of the International Railway Company, Buffalo, N. Y., called the meeting to order at 10.30 A. M., June 30, in the assembly room of the hotel, and introduced the Hon. R. F. Carter, mayor of the city of Niagara Falls, Ontario, who welcomed the railroad men to the city and voiced the appreciation of the city officials upon the selection of Niagara Falls as their convention place.

The secretary made several announcements, and, on motion, the reading of the minutes of the last meeting was dispensed with.

President Wilson then delivered his annual address, saying that while the beginning of the year pointed to a most prosperous era, since last October there has been a struggle to reduce operating expenses commensurately with the falling off in gross earnings. Ninety-eight per cent of the total earnings of electric railways is derived from receipts from passengers and consequently the electric railways had not suffered as heavily as the steam roads. He reviewed the work of the association during the year and commented particularly upon the work of the Committee on Standard Classification of Accounts.

The secretary, J. H. Pardee, reported that the number of active members had remained the same during the year. Three allied members had resigned and twenty-two new allied members had joined, making a total of 100 allied members. William Sharpe and J. C. Calisch, who were elected at the last convention as members of the executive committee, were compelled to resign on account of business engagements. E. J. Cook, of Rochester, and R. J. Dyer, Jr., of Auburn, were elected to fill the vacancies.

The next item of business was the report of the treasurer. H. M. Beardsley, secretary and treasurer of the Elmira Water, Light and Railroad Company, presented his report, showing total receipts for the year amounting to $10,875.23; expenses, $6,897.05; balance, $3,978.18.

C. Loomis Allen, of the Syracuse Rapid Transit Company, presented the report of the Committee on Classification of Accounts. This report indicated that it was unsatisfactory for the street railway companies and the steam railroads to make up their accounts on the same classification. Another objection was the incorporation of a theoretical depreciation account in the classification. Still another was the keeping of such a large number of primary accounts as were called for for the electric railways. After the committee had worked with the Interstate Commerce Commission and the Public Service Commission, a final classification of accounts was submitted which had been approved by the Interstate Commerce Commission, and will be promulgated on October 1. The resulting classifications were three in number, known as A, B and C. Classification A is kept by all roads having gross receipts of more than $250,000; classification B is kept by all roads having gross receipts between $50,000 and $250,000; classification C is kept by roads having receipts of $50,000 and less. The electric railways succeeded in convincing the regulating commissions that it would not be to the best advantage for electric railways or commissions to insist that steam and electric railways should account upon an identical classification.

Concerning the question of depreciation it is stated that the Interstate Commerce Commission in its classification will not promulgate depreciation, but will depend upon the second year upon what a majority of the state commissions will do with the classification as to whether they shall incorporate it in the order for the second year's operation.

In presenting the report of the Committee on Electric Express and Freight Service Mr. Allen stated that W. C. Collins had carried on most of the work in connection with this report. The committee had held four meetings. At the first meeting Mr. Collins was elected secretary, and since that time the bulk of the work had devolved upon him. There had developed, however, several matters which he would call upon the members of the committee to talk about. These were the question of rates and the question of blanks. He asked A. Eastman to deliver the report upon the question of rates.

Mr. Eastman stated that possibly no uniform or standard form should be adopted in compiling express and freight rates. He believed, however, that it would be to the interest of all electric railway companies to adopt a uniform tariff sheet, if for no other purpose than to make the filing with the Public Service Commission more uniform and standard. Any comparison of figures concerning the freight rates established by different companies would be very misleading, and would indicate that the company having a few miles of track was getting a much higher rate per ton-mile than a company with considerable mileage. This results from the fact that a five-mile haul at a rate of ten cents per hundred gives a rate of forty cents per ton-mile, when possibly the same commodity would be hauled fifty miles at a rate of twenty cents per hundred, giving a rate per ton-mile of eight cents; while if the five-mile rate were taken as a basis, the fifty-mile haul would amount to ten times as much as a five-mile haul, or $4 per ton-mile. It can therefore be clearly seen that the length of haul controls the rate per ton-mile. A number of the electric railway companies have adopted a minimum charge of ten cents per shipment, but unless competition is such that it is absolutely necessary to do so, the author did not think that the minimum charge should be less than fifteen cents per shipment, and it should be twenty-five cents when possible.

There was no discussion upon this section of the report and W. C. Collins was called upon for his comments.

Mr. Collins suggested that the best results could be accomplished if a considerable amount of standardization should be done in order to evolve a system that should be sufficiently elastic to cover all roads and all conditions. An important point to be taken into consideration is the difference in operation. A city company operating with an express messenger on a car would not need such an elaborate system as a large interurban road operating through towns with agents. It is just such cases as these that it is necessary to harmonize. The primary blanks would be the same, however, for all companies. He then described the blanks which would be needed to carry out the different functions necessary under different regulations of service.

Edgar S. Fassett, general manager of the United Traction Company, of Albany, N. Y., stated that there were several points which should be taken into consideration concerning the Interstate Com-

merce Commission. He said that, judging from the most recent decision of the courts, any freight or express which is consigned to points outside of the state or which comes from points outside of the state and is consigned to a freight or express company, brings the electric railway company under the Interstate Commerce act, with all its conditions. He has recently issued an order making it impossible for his company to accept freight and express consigned to points outside of the state or to receive from any steam railroad any freight or express coming from outside of the state.

The next report was by A. R. Walsh, of the Schenectady Railway Company, on the question of freight and express departments. Mr. Walsh considered that the total operating expenses per car-mile for carrying freight varied from twenty cents per car-mile to $1.02½ per car-mile. In averaging these costs it was discovered that the company that operated for twenty cents per car-mile earned a gross of forty-four and one-half cents per car-mile, while the company that operated for $1.02½ per car-mile earned in gross a fraction over $1.28 per car-mile. The company with the operating expenses of $1.02½ per car-mile earned one and one-half cents net more per car-mile than the company which operated for twenty cents per car-mile.

There was a large variation in the mileage—196,602 miles for one company, against 30,515 for the other. The one company in ten months earned almost $50,000 gross more than the other, while the expenses were only about $8,000 more. What makes the cost of operation vary so in this particular case is the vast difference in mileage.

One company operated for thirty-three cents per car-mile, and earned net about seventeen and one-quarter cents per car-mile. Another company operated for seventy-three and three-quarters cents per car-mile and while it earned gross eighty-one cents per car-mile, it only earned net about six and one-half cents per car-mile. Neither of these companies did any delivering by wagon, both of them handling nothing but freight; consequently, they had no stable expenses to figure in.

There is no doubt that the express and freight service on electric lines is a great convenience to the merchants, as it is possible for them to get quick service at times when they find themselves short of some particular article. It enables them to carry a smaller stock, and the result is that the electric roads get a large number of shipments.

High charges against the freight department are not right. Taking a freight car and a passenger car of equal weights and equipment, on a twenty-mile run the consumption of power by the freight car will be considerably less than that of a passenger car.

It has been said that an arbitrary charge per mile should be assessed against the freight and express cars. This might be all right if the freight and express privileges were leased to another company, but where the railway company is doing the work itself or where it has a separate department, it would seem that a proportion of the operating expenses should be charged.

Where the companies carry freight in combination cars the costs, of course, decrease.

The author considers that where freight and express is given a proper chance it will be found to be a profitable business.

Mr. Allen moved that the incoming president should appoint a new committee upon freight and express to continue the work for another year. This motion was carried.

The report of the Committee on Height of Car Steps was presented by E. F. Peck, chairman.

The report stated that the committee had held several meetings and that, in so far as the question immediately related to cars now in use, it had been unable, on account of the greatly varying conditions found on many roads, to come to any decision which would be of practical value, as it was very evident that at least the roads which have been represented at the meetings had individually given the matter careful consideration, and had not been able to arrive at any definite conclusion.

The report rehearsed the evolution of the electric street railway from the days of the horse-car, and indicated how the problem was involved by the matter of the spacing of the centres of the tracks.

In the case of closed cars it had been possible to keep within limits which seemed to be reasonably convenient for passengers generally. The committee felt warranted in making the recommendation that in the design of cars to be built in the future for use in cities, the height and rise of steps be, measuring from the top of rail, not more than seventeen inches; from step to platform, fourteen inches, and from platform to floor of car not more than ten inches. In no case did it consider the use of two steps from the street to the platform advisable.

In the case of double-truck, the width of track centres is the controlling condition. This limits the width of the car body, making it necessary to so design the steps that the truck frame, as well as the wheels, in swinging at curves, will have clearance under the step.

In the case of open cars so much depends upon the size of the motors, condition of roadway over which the cars run, as affecting the clearance above rails, and maximum allowable width of car, that the committee feels that perhaps the only reasonable recommendation which can be made is that in all cases the distance from the rail to the step be made as small as possible and the height from the step to the car floor be not more than seventeen inches.

In reply to an inquiry H. A. Benedict suggested that eight inches would be a proper width for a car step.

The report of the Committee on Model Car Repair Shop was presented by H. A. Benedict, chairman. This report gave elaborate details for a model car repair shop accommodating 100 cars. It is assumed that the site is a fairly level stretch of ground having a frontage of 570 feet and a depth of not less than 450 feet. Unprotected structural steel is at the mercy of a conflagration where wooden car bodies below or adjacent to it furnish fuel to distort and weaken the vital parts of the building. If reinforced concrete is used these risks are minimized, if not entirely eliminated. Brick is used for curtain walls which support only their own weight. A unit bay thirty-two feet wide from centre to centre of columns transversely and fourteen feet centre to centre of colums longitudinally is adopted. With the width of thirty-two feet the tracks may be placed on fourteen-foot centres, allowing nine feet from the centre of the outside track to the centre of the adjacent wall. This arrangement gives ample room between and alongside tracks. To secure proper lighting in the bays, which are entirely dependent upon overhead light, and to supplement such side light as may be secured from windows in the exterior walls, a uniform, continuous skylight ten feet wide is placed in the roof of each bay on its axis. A car sent to the shop for repairs is switched to certain of the tracks and brought in over the repair pit. This pit is served by pit jacks and by two ten-ton electric traveling cranes in each bay. Each crane is equipped with two five-ton electric

traveling hoists. If the car body needs either carpenter repairs or painting it is moved to an adjacent track in the bay and is lowered to a pair of shop trucks. It is then hauled to the carpenter or paint shop. For ordinary repairs the trucks are left over the pit where the car body was removed, and are placed in condition to receive the body after it has been returned from the paint or carpenter shop or another car body of the same type. Oil storage is provided in a separate building adjacent to the stock room. A brass foundry and foundry shop are provided adjacent to the forge shop. To afford efficient fire protection for the contents of the shops, a thorough system of hydrants, both inside and outside of the building, is provided. All hydrants are connected to a 25,000-gallon pressure tank at the rear of the property, as well as to the city water supply. As the buildings themselves are non-inflammable, no sprinkler system is recommended.

W. W. Cole thought that the location of the repair shop should be given very careful consideration. He has found that where repair shops are located at some point considerably out of town, it creates a very large non-revenue mileage in shifting cars to the shop. There is also a tendency to hold the cars too long before sending them to the repair shop, or a tendency to increase the amount of repairs done at the car-barns.

R. E. Danforth, general manager of the Public Service Corporation of New Jersey, said that in providing shops for scattered systems it is an open question whether a central repair shop is of material value. In New Jersey his company has to shift cars forty miles to a central repair shop. Where a well-designed division repair shop is provided it is often the case that the operating expense is less than on a division where a central repair shop is located. Each division master mechanic is particularly interested in the cost of operation of his particular cars, and never spends an unnecessary dollar upon a car when he gets it in his division shop. When he sends the car to the general shop for the annual overhauling he leaves as little as possible to be done at the general shop.

TUESDAY AFTERNOON SESSION.

The Tuesday afternoon session was called to order at 2.45 o'clock by Edgar S. Fassett, first vice-president.

The first paper was entitled "Commutating-Pole Railway Motors," and was read by E. A. Anderson, of the General Electric Company. This paper described the characteristics of the commutating-pole motor and indicated the advisability of adapting this type of motor to railway work. Replying to a question concerning the comparative cost of the commutating-pole motor, Mr. Anderson said that the extra cost of manufacture would probably be about twenty-five per cent. It was a question of increasing the reliability and buying that reliability as cheaply as possible.

There was no further discussion on this paper, and the session adjourned to make a trip over the gorge route and visit points of interest on the Canadian side of Niagara Falls.

WEDNESDAY MORNING SESSION.

The Wednesday morning session was called to order at 10.40 o'clock. The first paper was entitled "Observations on the Pay-as-You-Enter Car by the Mechanical Man," by W. H. Evans, master mechanic, International Railway Company, Buffalo, N. Y. This paper described the several forms of pay-as-you-enter cars which had been installed. In making an effort to reduce the weight of the cars and to simplify the operation of the equipment, particularly in connection with the pay-as-you-enter system, it is perhaps a very opportune time for railway companies to inaugurate equipment arranged for single-end service. With comparatively slight expenditure for necessary track arrangement which will facilitate the operation of cars on the single-end plan, a very decided improvement can be made in the reduction of the weight of the cars and in designing a stronger, more comfortable and a generally more satisfactory car than can be arranged for in double-end operation. The saving in the construction per car will easily offset the expense for the rearrangement of the tracks to permit single-end operation.

Attention was called to the Buffalo plan of fare collection. This arrangement consists of a fare box, or car safe, as it is called, with a suitable receptacle for receiving fares at the top, with a tripping device from which they are dropped into an inner cash box, where the fare is securely deposited until it is conveyed directly to the counting table in the treasurer's office. The small cash boxes are received from the treasurer's office unlocked, and in that position are placed on the inside of the car safe and receive all of the fares collected on the car from the time it goes into service until it is returned to the car barn.

Following the reading of this paper the meeting was addressed by Acton Burrows, secretary-treasurer of the Canadian Street Railway Association.

The next paper was entitled "The Pay-as-You-Enter Car from an Operative Standpoint," and was presented by C. A. Coons, superintendent of transportation, International Railway Company, Buffalo, N. Y. This paper described the method of instructing the trainman for handling passengers on the pay-as-you-enter car. The company has found that the car has become highly popular with both patrons and employés. Among the various advantages and merits of this type of car from an operating standpoint the following may be mentioned: Increase in revenues due to fares previously missed and otherwise appropriated, which are now dropped into the receiver and fare box; increase in speed due to cars being able to take on and discharge passengers simultaneously; decrease in regular cars operated, which necessarily decreases mileage as well as the number of car-hours; decrease in the number of accidents due to the presence of the conductor on the rear platform at all times; alleviation of conditions leading to jostling, crowding and other discomfort to passengers formerly caused by conductor pushing through to collect fares.

Duncan McDonald, general manager of the Montreal Street Railway Company, was introduced as the father of the pay-as-you-enter car. Mr. McDonald addressed the meeting very briefly upon the advantages of this type of car and said that his company was very well satisfied with its operation.

Mr. Danforth described the operation of the pay-as-you-enter car on the system of the Public Service Corporation of New Jersey. This type of car appears to suit the patrons very well, and in spite of the fact that it is of the single-end, cross-seat type, with a large rear platform, it has won the approbation of the people on the company's lines and eliminated all trouble and annoyance formerly caused by the conductor after the passenger had once entered and taken his seat. The company finds that it can carry almost as many passengers per car with some degree of comfort, and can satisfy a greater number of passengers on each car. There has also been an improvement in the collection of fares. After the company had installed the first fifty pay-as-you-enter cars it investigated the possibility of rebuilding some of its old equipment, and it has been found that some 250 or 300 cars were so nearly of the pay-as-you-enter type that an expenditure of about $200

per car will put them in shape for that method of operation. Other cars were found well adapted for double-end construction, and the company is now putting through its shops about 300 cars, some for single-end operation and some for double-end operation.

C. R. Barnes, of the Public Service Commission for the Second District of the State of New York, was introduced and asked for a discussion on the subject, "The Use of Curtains on Front End of Suburban Cars During the Daytime."

W. R. W. Griffin, of the Rochester & Eastern Railway, stated that his company always operated with the front end closed, one of the reasons for this being that it is often possible to carry express that the traveling public would not like to ride with. In this way the company increased its revenue. Another reason was that passengers on a high-speed car, especially in a hilly country, saw too many "near accidents."

Mr. Pardee stated that where cars were operated at a very high speed it was well to keep the curtains down, as the possibility and imminence of danger always impress the passenger when looking straight ahead of the car.

E. F. Peck, general manager of the Schenectady Railway Company, stated that on the Schenectady system the curtains were always up in the daytime. No trouble had ever been experienced. He thought that it made a much pleasanter trip for the passenger, and that in case the motorman was subjected to an accident or overcome in any way it gave the passenger and conductor a chance to see what was happening on the front platform, and in that way resulted in preventing a serious accident. Of course, at night the feature of the interference of the light is a serious thing, and it is then necessary to darken the front end of the car.

The next subject for discussion was "Some Practical Means to Enable Passengers Desiring to Board Trains to Stop Them at Flag Stations."

H. S. Williams, of the Utica & Mohawk Valley Railway, stated that his company provided a system of flag-stop signals consisting simply of a cast-iron switch operating five lights. This is manipulated by the passenger by means of a rope which is pulled at the time the car approaches. There is very little trouble in the maintenance of this signal. The lamps are lighted for only a small portion of the time, and burnouts amount to practically nothing. The box is made of wood, because the experience of the company has been that this stands up better than iron. The signal costs approximately $2.95 to build. This includes the entire cost of lamps, switches, sockets and everything else connected with the signal. The maintenance does not amount to over twenty-five cents a year for each signal.

Upon the suggestion of Mr. Barnes, a motion was carried requiring the incoming president to appoint a committee of five to investigate this subject and report.

The next topic was entitled "The Equipping of City Cars with Red Flags and Lanterns on Lines which Cross Steam Tracks at Grade."

Mr. Coons did not thing that it was a good plan to carry either red flags or lanterns on electric cars. If there was time enough to get out a red flag or a lantern to flag a train, there was time to get the passengers off.

Mr. Barnes did not think that the flagman employed at a steam-road crossing by the steam road affected the operation of the electric car in any way. He did not think that he was of any benefit in safeguarding the operation of the electric system.

Mr. Fassett was of the opinion that it would pay any electric railway company to have its own flagman at all places where a steam road crosses the electric road at grade.

Upon motion it was decided to refer this topic to the Rules Committee to report at the next quarterly meeting, if possible.

The next topic, "The Practice of Carrying Musical Instruments on City Cars," referred to the annoyance which is sometimes caused by the carrying of large instruments such as horns or drums upon crowded cars. The consensus of opinion appeared to be that it was the proper plan to issue either single permits or yearly permits, subject to cancellation if the carrying of the instrument proved an annoyance.

The paper entitled "Signals for Interurban and Local Traffic" was read by title.

Mr. Cole suggested that in view of the important work of the Committee on the Classification of Accounts, it would be well for the incoming president to appoint a committee of three to carry on this work during the next year. A motion to this effect was carried.

Mr. Cole extended a vote of thanks on behalf of the association to the retiring president for the very able manner in which he had conducted the work during the past year. President Wilson responded very briefly. He then called the attention of the meeting to the fact that Mr. Cole, who had been an active member of the association for many years, serving on its committees and as an officer, was retiring from the active management of an electric railway property which was a member of the association. It seemed fitting that a resolution should be spread upon the minutes electing Mr. Cole an honorary member of the association. This resolution was adopted unanimously.

The report of the nominating committee was presented as follows:

For president, E. S. Fassett, Albany.

For first vice-president, E. F. Peck, Schenectady.

For second vice-president, C. Gordon Reel, Kingston.

For secretary, J. H. Pardee, New York.

For treasurer, H. M. Beardsley, Elmira.

Executive committee: E. J. Cook, Rochester; R. A. Dyer, Jr., Auburn; J. W. Hinkley, Jr., Poughkeepsie; T. W. Wilson, Buffalo.

This report was adopted and the secretary instructed to cast a ballot for the ticket.

President-elect Fassett was escorted to the chair by Messrs. Cole and Cook. He addressed the meeting very briefly, stating his appreciation of the honor conferred upon him in his elevation to this position.

The convention was then adjourned.

Meeting of Lamp Testers.

A meeting of all the lamp inspectors in the employ of the Electrical Testing Laboratories was held in New York on July 6, 7 and 8. The following papers were presented and discussed:

"Visual Inspections of Electric Lamps," by C. E. Currier.

"The Best Procedure in Lamp Inspection," by C. H. Stephens.

"The Selection of Life Test Samples," by H. E. Allen.

"The Effect of Varying Test Quantity Upon Rejections," by W. F. TenEyck.

" 'Bugs' in Photometry," by E. L. Peck.

"Lamp Inspections at Purchasing Companies' Storehouses," by W. J. Bray.

"The Criterion of Lamp Value," by A. W. Minty.

"The Value of Laboratory Tests," by W. H. Rolinson.

"The Functions of a Lamp Inspector," by George H. St. John.

"The Responsibilities of a Lamp Inspector," by L. J. Lewinson.

THE CONTRACTOR AND ILLUMINATION.

BY VAN RENSSELAER LANSINGH.

Ten years ago when a merchant contracted with a central station for electric light, he figured the installation purely from the standpoint of cost; so many lamps would be required of so much candle-power, and his monthly bill was forecast at approximately so much.

He bargained with the contractor in the same way and the question was: How much will it cost to wire my store for ten lights? The contractor gave his price on a molding job and on open cleat work and the customer took his choice. No mention was made of illumination and if plain drop lights were not used, fixtures and glassware were selected for price and not for efficiency. The central station representative suggested that the lights be placed so many in each window, so many along the counters, etc., and the contractor, when his figures were quoted, met the cry of "too much" with such advice as to rearrangement of outlets as he calculated would secure him the job. And so throughout the transaction the installation was considered merely so many electric lamps—not light, not illumination.

With the increasing popularity of electric light for residence, store and factory lighting, came a gradual and growing enlightenment on the subject; and the matter of efficiencies and economies in the various systems of artificial illumination became of general interest to the public.

As an outgrowth of and correlative with this development and the introduction of the various lamps of higher efficiency and scientifically designed globes and reflectors, has arisen a popular demand for accurate knowledge on the subject of illumination, resulting in the evolution of the profession of illuminating engineering. Also, the central station itself is giving more and more consideration to the subject, realizing that after all what the customer is buying is illumination, not simply current, and that it is incumbent on the lighting company to see that he receives full value for his money. So to-day we find a number of the larger companies with illuminating engineers regularly attached to their commercial staffs; working out efficient lighting schemes for new customers, and rearranging old installations to reduce cost.

The contractor, however, has not yet taken up this phase of his work to the extent which might be expected. The prosperity of the contractor and the volume of his business depend largely on the demand for electric current for lighting and the satisfaction of his customer in the results obtained from each installation. It is just as important to the contractor that every lighting system he installs should give the greatest amount of useful light, and be as economical as possible in consumption of current, as it is to the central station who reads the meter.

Many contractors have the idea that illuminating engineering is too complex and too large a problem for them to handle, taking the stand that the study of scientific lighting is outside their province and that they can not give the time necessary to mastering the subject. They sell motors, however, advising their customers without hesitation on matters of speed and drive, and the details of friction load and power-factor. Also when they give an estimate on a large generator set they do not hesitate to call on the manufacturer for assistance and the job is figured for them when necessary.

Just so, the more advanced problems in illuminating engineering may be handled on the advice of an experienced illuminating engineer; but the simple daily problems which the contractor encounters in the wiring of small stores, residences and factories require only a small amount of study, if it is backed up with a large amount of observation and plenty of good common sense. No highly developed technical education is necessary, but simply a thorough understanding of the fundamental principles of good illumination.

No contractor, nowadays, can succeed who considers his work to be limited to the mere screwing up of cleats and the stringing of wires. He must be part of the wave of development which is as broad as the country, embracing all who work in the field. He must be a co-operator. He must consider his work not "wiring for lights," but "wiring for illumination" and efficient economical results must be the end in view.

There are, of course, numerous instances where contractors large and small have already taken the broader view of the matter and are striving for efficiency. We cite only random cases, but they serve to illustrate the fact that those contractors who are to-day studying illumination and applying its laws in their work, are the farsighted forerunners of this inevitable development.

Frederick C. Ross, of 255 Greenwich street, New York city, for example, is constantly working among his old customers figuring with them the economies which can be realized by the installation of tungsten and other high-efficiency lamps with proper reflectors. Mr. Ross says he realized some time ago that the most prolific field for the contractor lay in the line of redesigning present installations and reducing current consumption, and he has made a special study of the results which may be obtained in this work.

J. Francis Southgate, of Worcester, Mass., is another contractor who has made a number of installations of Holophane arcs and gem lamps, and materially reduced his customers' current costs.

Walter Kidde, of the West Street Building, New York city, though primarily a mechanical engineer engaged principally in the construction of large manufacturing plants, has considered the matter of illumination of the greatest importance, and in the plant of the Brunswick-Balke-Collender Company, in Long Island City, and their New York city show rooms has produced some exceptionally fine results. The efficiency and tone of the show-room lighting has called forth much favorable comment and attained considerable publicity.

Contractors must look the situation fair in the face and realize that the rapid strides of the last few years in this field have affected them quite as much as the lighting company itself.

Electric lights in future will be installed, not as lights, but "for illumination," and it rests with the contractor in large measure to facilitate this progression.

The Chicago Sanitary District Hydroelectric Development.

The investigating committee of the Citizens' Association, of Chicago, Ill., appointed to study conditions surrounding the Chicago Sanitary District hydroelectric development, has reported that if the district is not hampered in the future in its efforts to sell electricity its net income should amount to at least $500,000 a year. This capacity should be reached in six months. Ultimately the capacity may be increased to 80,000 horse-power, with a net annual revenue of $1,500,000. Since January the Sanitary District has installed three generators capable of producing continuously 16,500 horse-power, and for peak service 20,600 horse-power. In six months the plant should be capable of producing continuously 27,500 horse-power. This will be increased to 30,000 horse-power within two years, when the flow is increased by widening the river.

National Electrical Contractors' Association.

Eighth Annual Convention, Chicago, Ill., July 15, 16 and 17.

THE eighth annual convention of the National Electrical Contractors' Association will be held at Chicago, Ill., July 15, 16 and 17. Headquarters will be at the Auditorium Hotel, the registration department and directors' room being located on the parlor floor, the banquet room on the sixth floor being used for the business sessions. The registration department will be opened at 6 P. M., July 14. All badges and tickets for entertainment will be issued from the registration department and no badges will be issued until payment by party registering of the fee for tickets. The programme insures a pleasant and profitable meeting, and indications point to a large attendance. The general programme of the convention is announced as follows:

JULY 15.

Open session, 10 A. M.

Business session, 2 P. M.

Men's banquet, 7 P. M., in large banquet hall of the Auditorium Annex.

Ladies' banquet, 7 P. M., in small banquet hall of the Auditorium Annex.

JULY 16.

Open session, 10 A. M.

Business session, 2 P. M.

Business session, 7 P. M.

Ladies' theatre party, 7 P. M.

Rejuvenation of the Sons of Jove, time and place to be announced later.

JULY 17.

All-day outing at Michigan City, boat leaving Chicago at 9 A. M. and returning at 6 P. M.

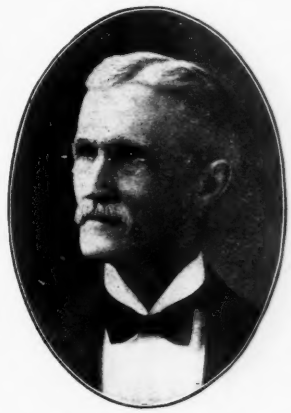
Both the open and business sessions will be held in the Assembly Room, on the sixth floor of the Auditorium Hotel.

There are a great many matters of importance to come before the business sessions and all of the members are requested to convene promptly and remain through the entire meeting.

The open sessions will be interesting and instructive, addresses being made by the following well-known men:

JAMES R. STRONG,
President National Electrical Contractors' Association.

W. H. MORTON,
Secretary National Electrical Contractors' Association.



JOHN R. GALLOWAY,
Treasurer National Electrical Contractors' Association.

G. M. SANBORN,
First Vice-President, National Electrical Contractors' Association.

WEDNESDAY, JULY 15.

Address of welcome, president of the Electrical Contractors' Association of Illinois.

Opening address, James R. Strong, president of the National Electrical Contractors' Association.

"The Electrical Contractor's Opportunities in the Illuminating Field," George Loring.

"The Relations Between the Underwriters and the Contractor," W. H. Merrill, Jr.

THURSDAY, JULY 16.

"Illuminating Engineering," J. R. Cravath.

"The Relations Between the Lighting Company and the Contractor," Alex Dow.

"The National Electrical Contractors' Association," Seth B. Witherbee.

The local committee has practically completed all arrangements, and the following have been placed in charge of the different features of the entertainments: Registration, badges and tickets, C. R. Kreider; banquets, Ernest Freeman; entertainment and vaudeville, Arthur Frantzen; outing boat, Henry Newgard; outing grounds, Warren Orne.

The officers of the National Electrical Contractors' Association are as follows:

President—James R. Strong, New York, N. Y.

First vice-president—G. M. Sanborn, Indianapolis, Ind.

Second vice-presidents — Charles R. Kreider, Chicago, Ill.; F. C. Werk, Cleveland, Ohio.

Treasurer—John R. Galloway, Washington, D. C.

Secretary—W. H. Morton, Utica, N. Y.

Sergeant-at-arms—J. C. Sterns, Buffalo, N. Y.

IMPROVED CONDITIONS IN THE ELECTRICAL INDUSTRY.

SATISFACTORY RETURNS FROM ALL PARTS OF THE COUNTRY—INDICATIONS OF A RETURN TO NORMAL CONDITIONS.

That there is a well-defined improvement coming about in the electrical manufacturing industry is attested by the increasing volume of orders and inquiries for new material. Last week we published an interview with Walter H. Whiteside, president of the Allis-Chalmers Company, in which he spoke very encouragingly concerning the revival of business and the renewed activity in all branches of the industry. Supplementing his statement of last week, Mr. Whiteside says: "There is a continuation of the progressive conditions stated in my interview of last week. At the present rate of improvement normal conditions will again be realized within a very short time."

For the year ended June 30, 1907, the Allis-Chalmers Company showed an operating deficit of $387,298. The earnings for the year ended June 30, 1908, will show a substantial profit available for dividends on the preferred stock. The strength of the stock and bonds of the company is attributed to the better showing, not only in earnings, but in new business as well.

The business of the General Electric Company continues to show steady improvement. Gross sales of new apparatus are running now at the rate of fully $40,000,000 per annum, as against a rate of $35,000,000 per annum in February and April. The total of new orders for the three months was $10,033,172. During March several large orders were received. During the last two months there has been a steady accumulation of orders, and in the last month the company has been able to show gross sales of $3,500,000.

It is stated that there is no truth in the report that directors of the National Carbon Company are contemplating an issue of five per cent bonds to be used in retiring the $4,500,000 preferred stock and placing the common on a seven per cent basis. As a matter of fact, an increase in the National Carbon common dividend rate is an assured development for the future. Directors will not make any move, however, until the situation is more settled. Since the beginning of the current fiscal year, on February 1, National Carbon earnings have been running at the rate of about $900,000 net per annum, which compares with $924,801 for the fiscal year ended January 31.

The business of the Westinghouse Electric and Manufacturing Company is showing a gradual improvement. Recently the company received $400,000 in new orders within the course of two or three days. The orders this month are expected to show a substantial increase over the preceding month.

The hearty co-operation of the readjustment committee with the various other committees and the work performed by the former committee in making the plan successful are subjects of favorable comment on the part of the creditors and Westinghouse interests.

That the requests of the readjustment committee will be met before September 1 there is little room for doubt. The recent advance in the notes and bonds of the company indicates as much.

The Crocker-Wheeler Company reports a large increase in inquiries for motors, generators and other electrical apparatus which it is receiving through its branch offices all over the country. The company feels confident that when the great volume of business indicated by all these inquiries is under way normal conditions will again prevail.

Westinghouse Electric and Manufacturing Company Readjustment.

The readjustment committee of the Westinghouse Electric and Manufacturing Company in its report gives subscriptions to the merchandise creditors' plan as follows: By merchandise creditors, $4,135,912; by company's employés, $596,650; by stockholders, $2,214,300; by security investment company, $1,325,000; by George Westinghouse, $1,500,000. Total, $9,770,862.

Of this amount the subscriptions payable in cash as distinguished from those payable from the surrender of claims aggregate $5,634,950.

Upon the strength of these figures the reorganization committee announces its willingness to co-operate and to accept until September 1 the merchandise creditors' plan upon condition that the full conditions of the merchandise creditors be met.

The committee further recommends and requests the bank creditors to agree to accept in exchange for their claims one-half of the par value thereof in convertible sinking fund bonds of the company at par and for the other one-half either five per cent notes of the company in three equal amounts maturing respectively in four, five and six years from that date to the extent of thirty per cent of the face value of their claims and for the balance of their claims assenting stock of the company at par or at the option of the creditor in respect of the one-half of the claim not covered by the convertible bonds, five per cent notes of the company maturing fifteen years from that date.

Ohio Electric Light Association.

The fourteenth annual convention of the Ohio Electric Light Association will be held at the Hotel Victory, Put-in-Bay Island, Lake Erie, Tuesday, Wednesday and Thursday, August 25, 26 and 27. The following topics will be presented in the form of papers at the meeting:

"Should Central Stations Do Wiring?"

"Why Municipal Ownership of Lighting Stations Has Not Been a Success."

"How Can We Best Increase Our Business?"

"Experience with Luminous Arc Lamps."

"Electric Signs and Other Special Uses of Electricity as an Adjunct to Profitable Station Work."

"Gas and Gasolene Competition, and Best Ways to Meet It."

"Illuminating Engineering."

"Best Ways and Means of Keeping Out and Getting Out Private Plants in Central Station Territory."

"The Gas Engine in Central Station Work."

"Gas-Producer Plants and Oil Engines and Their Results."

Report upon the experience of a large number of central station men on the tungsten lamp.

DeForest Wireless Telephone Tests.

Lee de Forest, the well-known wireless telegraph and wireless telephone inventor, returned to New York recently after a long trip abroad. Mr. de Forest installed wireless telephone apparatus on several naval vessels for the Italian Government. During his stay in Paris he was afforded an opportunity by the French authorities of using the long antenna on the Eiffel Tower. It is stated that messages and songs by wireless telephone were picked up by warships near Marseilles, 300 miles distant. Mr. de Forest says that he heard very plainly the messages sent out from Glace Bay, on this side of the Atlantic, by the Marconi company. He believes that the Eiffel Tower tests prove that it is feasible to send messages from New York to Paris if the new tower of the Metropolitan Life Building, which is now nearing completion in New York city, can be used.

New Hydraulic Plant of Brillanne, France.

By C. L. Durand.

THERE has been recently opened in the Mediterranean region of France a hydroelectric plant which has a considerable interest from the fact that it is one of the largest to be erected in the south of France, and again, it uses the highest voltage, 52,000 volts, which has as yet been employed on the Continent.

The new plant is located on the Durance River, at Brillanne, and it forms part of the extensive system of hydraulic plants and pole-lines which are under the control of the Energie Electrique Company. Several of the already-existing power plants of this region have been described in previous issues of the ELECTRICAL REVIEW. Of late the enterprise has taken a considerable development, as it was desired to extend the system of pole-lines as far as the important centres of Marseilles and Arles. In Marseilles especially, a large amount of current is to be used, both for the lighting and motor circuits and also for the city tramways. In view of this fact the company has been engaged in constructing a number of new plants, of which the present station is the first to be finished.

EXTERIOR VIEW OF THE BRILLANNE HYDROELECTRIC PLANT AND TRANSFORMER HOUSE.

Having a capacity of some 12,000 horse-power, the Brillanne plant is designed to work in connection with a second plant which is now being erected on the same river at Ventavon, about forty miles to the north, to furnish 15,000 horse-power. Following this there will be a number of other hydraulic plants finished in the near future in the same region. One of the largest of these is the Verdon plant, on the river of the same name, which is designed to give 15,000 horse-power. Other plants are the Timeé, Fontan and Sorge, etc.

Referring to the stations of Brillanne and Ventavon, located on the Durance River, these two hydraulic plants, the first of which has been in regular service for some months past, and the second in course of construction, are designed to be operated in parallel. At present they are connected together by two high-tension pole-lines. The total amount of power will be transported from the station of Brillanne by means of three high-voltage pole-lines on the one hand, which are constructed as far as Marseilles and are to end in a transformer station of large size. This latter station, which is one of the largest substations which has as yet been erected on the Continent, is located at the village of Allauch, a few miles' distance from Marseilles. An illustrated account of the Allauch plant has already appeared. Another part of the current from the hydraulic plant will be carried upon two high-tension lines which proceed in the direction of Arles and end at another substation which is to be erected in the neighborhood of that locality.

The long distances which separate these hydraulic stations from the points of utilizing the current have resulted in the use of an unusually high voltage upon the pole-lines of the present system, the highest which has been reached as yet on the Continent. It is from 55,000 to 57,000 at the start of the pole-lines from the Ventavon plant, and 52,000 on the lines from the Brillanne station. The use of such a high voltage made it necessary to design a series of new machines and the accompanying apparatus for this tension. On account of the large amount of power which comes into play in the present case, there must be a distinct separation between the medium-tension machines and the high-tension transformers of the plant.

INTERIOR VIEW OF BRILLANNE HYDROELECTRIC PLANT.

A BANK OF THREE HIGH-TENSION TRANSFORMERS OF BRILLANNE HYDROELECTRIC PLANT.

The present account of the Brillanne hydraulic plant has been obtained from information on the subject which A. Garfield, one of the chief engineers of the

French Thomson-Houston Company, has kindly furnished the writer, and the illustrations will bring out the leading details of its construction. In general the plant is made up of two separate buildings, the first of which is designed to contain the main part of the running machinery, such as turbines and alternators, together with all their accessories for operation and regulation. The second building, which lies near the former, contains the main transformer room and here are installed the static transformers and the high-tension apparatus for regulating the lines at the point where they leave the station. The buildings are of a considerable size, and the turbine house covers an area of 1,000 square metres, while the transformer room covers 11,000 square metres.

As to the hydraulic work which was carried out for the Brillanne station, it differs somewhat from the usual practice in the fact that there is no dam erected across the river at this point. The river bed is much too wide to allow of carrying this out in the present case. The water is accordingly taken off by a simple side canal, and as the current is rapid at this point, a sufficient amount of water is given by the canal for operating the station, the average flow being fifty cubic metres per second, and the minimum flow forty-five metres. The total length of the canal from the off-take point to the station is about eight kilometres, and the difference of level is thirty-eight metres. At a point midway in the canal it is enlarged considerably so as to form a vast settling basin, and here the width is forty-three metres. A dredge crane is arranged so as to take out the gravel which deposits here. Near the station the canal ends in a main basin built of masonry which has 8,000 square metres surface and is divided into two parts by a masonry wall. From here there are five penstocks of 2.7 metres inside diameter which lead to the turbine house, and a smaller one of 1.2 metres for the exciter turbines. After passing through the wheels, the water flows in an off-take canal of 1,030 metres length to the Durance River. This canal is taken across the railroad and the roads in two parallel flumes of fifty metres length.

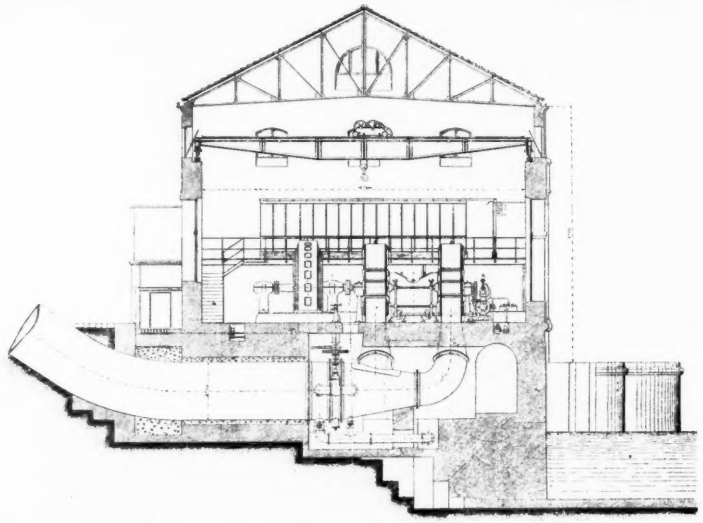
The mechanical and electrical outfit of the plant, which was installed entirely by the present company, comprises five groups of turbine-alternators. The turbines are of the Francis pattern and are furnished by the Escher-Wyss firm, of Zurich, having two main wheels, each of which is mounted in a separate water-chamber. The two wheels have a common outlet for the water into the off-take canal. About 3,500 horse-power is the capacity of each of the present wheels, and they are designed for use upon a twenty-two-metre, net, head of water, including the height of aspiration, which varies between six and seven metres. A centrifugal governor of an improved type is provided for these machines, and it acts upon the crown containing the directing vanes by means of a relay motor. The latter is of the hydraulic type and works under oil pressure. The normal speed of the turbines is 250 revolutions per minute, but this speed can easily be raised or lowered so as to vary from 235 to 265 revolutions, either by simply working a hand-wheel or by the use of a small electric motor which can be operated from the main switchboard. This arrangement is indispensable for connecting the different machines in parallel in a rapid and efficient manner.

Each of the turbines is coupled directly and rigidly to the corresponding alternator. The latter machines have been designed specially for the present plant, and will produce three-phase current at twenty-five cycles, working at 7,500 volts normally. In this case the system of revolving field and fixed armature is used, and the field coils are formed of copper strip laid in slots in the laminated-iron field, while the armature winding is made up of lath-wound coils which are placed in the slots in the usual way. Each of the alternators has a capacity of 3,000 kilowatts.

For the exciting current of the five alternators of the plant there is provided a direct-current generator of 200 kilowatts, which delivers 110 to 125 volts to the exciter bars. There are two of these machines installed in the station, one of them acting as a standby. Both the generators are driven direct by Escher-Wyss turbines of the Francis type, of the 250-horse-power size. They are placed at one end of the dynamo room, along with a number of other groups which are used for various purposes throughout the station, including a set of motor-driven pumps for supplying the oil under pressure which is needed for operating the hydraulic motors of the governors.

Coming to the second part of the plant, the transformer post, this building is located at a hundred feet from the former. Here are installed the single-phase transformers of the plant, which are lodged in a series of cells or niches so as to be entirely enclosed when in normal service. These transformers are connected so as to deliver three-phase current, and as usual they receive the current from the alternators and are connected at the other side upon the pole-line. Each of the alternators of the plant has a three-phase, paper-insulated and lead-covered cable, which runs underground to the transformer room and is connected to a group of three of the transformers. The transformers are very well designed with respect to the high voltage employed. Each has a capacity of 900 kilowatts and a ratio of windings of 1 to 4, so that when they are connected in a set of three on the delta system on the low-tension side and on the star method on the high-tension side, they will raise the machine voltage of 7,200 to 52,000 volts between phases.

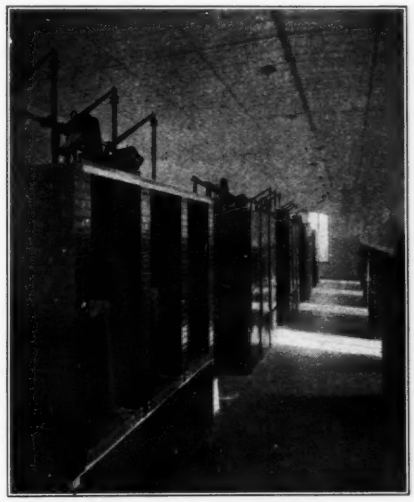
The present type of transformer required a very careful construction, and special attention was given to the insulation and to the cooling of the mass. The windings



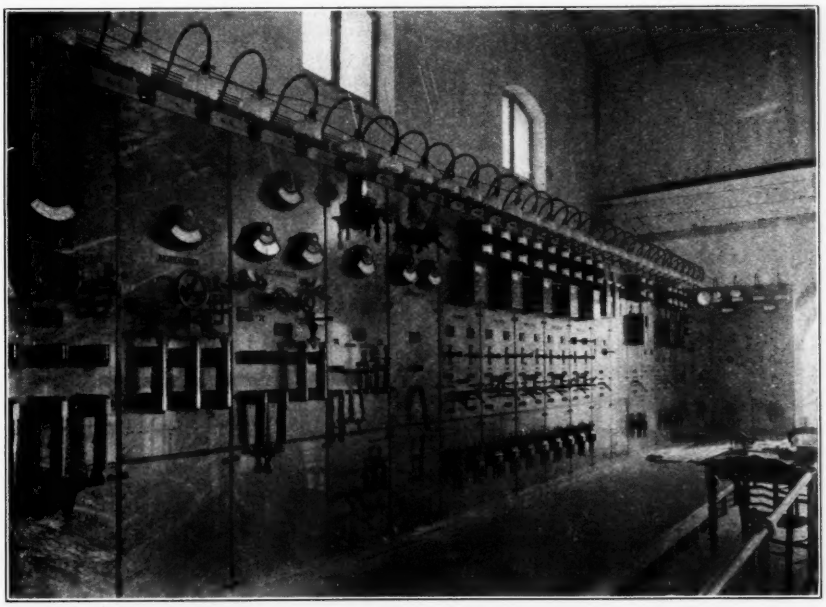
TRANSVERSE SECTION, BRILLANNE HYDROELECTRIC PLANT, SHOWING PENSTOCK AND DRAFT TUBES.

are entirely immersed in oil, and the latter is cooled in a constant manner by means of a cold-water circulation which takes place in a worm piping surrounding the body of the apparatus. A set of automatic signals has been provided for use with the transformers, and in case of an undue rise of temperature in any of the apparatus a corresponding signal is given to the attendants.

From each of the five groups of transformers corresponding to the alternators, current can be sent into the bus-bars of the switchboard. The bars are laid out in two series working at 50,000 volts, and the transformers can be switched on either set of bars. The latter are of bare copper wire of ten millimetres diameter. Each of the bars is mounted horizontally on triple-bell porcelain insulators of a special type, and is separated from the neighboring bar by a long slab of cement upon which are placed the insulators. Upon the bars are connected the starting wires for the three-phase pole-lines at 50,000 volts. The different circuits for the lines are also in bare copper. The method of mounting the transformers in the cells is seen in one of the illustrations. The overhead lines leave the station through a series of openings, and below these points



AUTOMATIC HIGH-TENSION OIL SWITCHES IN THE BRILLANNE HYDROELECTRIC PLANT.



VIEW OF MAIN SWITCHBOARD AND DISTRIBUTION PANELS, BRILLANNE HYDROELECTRIC PLANT.

is installed a series of lightning arresters of the Wunt pattern.

The different high-tension circuits (alternators, transformers and lines) are operated by special forms of high-tension switches of the company's design. These three-pole switches, whose phases are separated by brick partitions, have a double break in oil, and are operated each by a separate direct-current motor by means of suitable gearing and a set of jointed levers, which transform the rotary movement of the motor into a straight movement. This causes the operation of the switches by means of a set of rods, so as to open the three-phase high-voltage circuits. Strong springs give a quick break for the switches, preventing any arcing at the contacts. In this way it is easy to break a fully loaded line of 10,000 kilowatts working at 50,000 volts. The electric motor is started up by closing a small two-way switch which is mounted on the main switchboard and can be placed at any distance from the corresponding switch. Colored lamps on the switchboard are used to show at each instant the opening or closing position of the main switches in the other building. A set of automatic relays, which can be adjusted as desired, is used to open the main switches when the current rises too high. One of the illustrations shows the method of mounting the three-phase switches. Above will be seen part of the mechanism and the small electric motor. A set of iron covers closes the cells completely. Each set of three cells for a single switch is mounted separately, thus placing the switches a suitable distance apart. The constant value of the voltage is assured automatically at the ends of the pole-line at the substations of Arles and Allauch, that is, at a distance of about sixty miles from the hydraulic plant. This is carried out by an apparatus which is installed at Brillanne on the platform of the main switchboard. Switchboard transformers and a compensating apparatus are used in order to operate a low-tension circuit which serves as usual instead of a pilot wire. In the present case the apparatus is designed so that all the points concerning the line voltage and phases are reproduced in the indicator. The voltage of the low-tension circuit is used to operate the relay of the current-regulator, and its value corresponds at all times with that of the voltage at the distant ends of the line. The current regulator which is used in the present case is of the Thury pattern and is of double form; that is, it allows of a simultaneous and independent regulation of the voltage on each of the 50,000-volt bus-bars used for the start of the pole-lines. This takes place by the automatic working of a rheostat which is mounted in series on the exciting circuit of the alternator.

The security of the personnel is carried out in a simple and effective manner. All the apparatus for the operation, regulation or measurement for the two buildings are, without exception, supplied at 110 to 125 volts. For the direct-current circuits this is done by the use of electric relay motors, and for the alternating-current by means of transformers of voltage and current which are connected upon the high-tension circuits for the measuring instruments. All the operations for the different machines and circuits, both direct and alternating, are carried out from the main switchboard, which carries all the needed indicators for working the station.

The Brillanne plant is now able to furnish regularly a total of 10,000 kilowatts,

using a voltage of 50,000 volts between phases. At present there are four of the above-mentioned alternator groups in operation, and they have been delivering current in a regular way upon the line which passes to Marseilles at sixty miles distance. Current is used in the latter city for a number of mains, and this latter system, which is only in its first stages, will, no doubt, be increased rapidly in the near future. The first two groups and the pole-line have been working at 50,000 volts for some months past without any mishaps of any kind occurring upon the system during that time. At present the amount of power which is sent upon the line is estimated at 120,000 kilowatt-hours per day. A large part of the current is used in Marseilles by the gas and electric company of that city and also by the tramway company, which operates one of the largest systems on the Continent.

The overhead line is mounted in general upon iron trellis-work poles, which are made to take a comparatively straight course across the country and do not follow the roads. The poles are ten to twelve metres in height and are spaced seventy-five metres apart. On the poles are mounted three cables for the high-tension lines. One cable is placed at the top of the pole and the two others at the ends of a short cross-arm. Triple-bell porcelain insulators, tested at 120,000 volts, are employed.

BOOK REVIEW.

"Agenda de l'Electro." L'Electro. Brussels. Cloth. 280 pages. Illustrated. 4 by 6 inches. Price, 5 francs.

This is a useful little French handbook for engineers. It contains the usual information generally found in such works, such as the fundamental laws of electrical science, the principles of electrical applications, and practical information on electrical, steam and hydraulic machinery. Some interesting statistics of the electrical industries in Belgium are given and lists of technical societies and schools

Wireless Telegraph Companies Unite.

It is announced that the United Wireless Telegraph Company has obtained control of the International Telegraph Construction Company, one of its recent competitors. The International Telegraph Construction Company has built a number of stations in the United States and in several foreign countries. It is also stated that the United company has secured the services of Harry Shoemaker, the well-known wireless telegraph apparatus inventor.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

KANSAS CITY RAILWAY AND LIGHT COMPANY.

The Kansas City (Mo.) Railway and Light Company's earnings for the year ended May 31, 1908, are officially reported as follows: Gross, $6,144,549; expenses and taxes, $3,684,457; net, $2,460,092; deductions, $1,380,254; surplus, $1,079,838.

ASSOCIATED BELL TELEPHONE OPERATING COMPANIES.

The report of all the associated Bell Telephone operating companies, not including the long-distance lines of the American Telephone and Telegraph Company, for the month of April and four months ended April 30, shows an April gross telephone revenue of $9,882,200; general operating and maintenance expense, $7,143,500; net, $2,738,000; sundry earnings, net, $399,800; total net, $3,138,500, an increase of $216,400 over the same period in 1907; interest, $641,800; balance for dividends, $2,496,700. From January 1 to April 30 telephone revenue amounted to $38,924,400; general operating and maintenance expense, $28,771,500; net, $10,152,900; sundry earnings, net, $1,636,000; total net earnings, $11,788,900, an increase of $1,142,600 over the same period in 1907; interest, $2,615,400; balance available for dividends, $9,173,500.

UNITED RAILWAYS OF ST. LOUIS.

The report of the United Railways Company, of St. Louis, Mo., for the month of May and five months ended May 31 shows May gross of $920,765; expenses, $591,543; May net, $329,222; charges, $232,278; May surplus, $96,944. Five months' gross, $4,248,216; expenses, $2,795,250; five months' net, $1,452,966; charges, $1,154,714; five months' surplus, $298,252.

MEXICAN AND CENTRAL & SOUTH AMERICAN TELEGRAPH COMPANIES.

A résumé of the operations since organization of the Mexican Telegraph Company and of the Central & South American Telegraph Company has been issued as a joint statement by James Scrymser, president of both companies. Many inquiries have been made concerning the value of these properties, as the shares of the company have been traded in very little on the Stock Exchange. During 1907 235 shares of the Mexican Telegraph Company changed hands at prices ranging between $235 and $250 per share. In 1907 5,945 shares of the Central & South American Telegraph Company were sold at prices ranging from $105 to $110 per share.

The first cable of the Mexican Telegraph Company was laid in 1881, the second in 1889, the third in 1905, all in the Gulf of Mexico. The 1881 cable has been occasionally interrupted by abrasion on reefs, but in every instance the cable, beyond the point of interruption, has been found to be in excellent condition. The 1889 and 1905 cables have not been interrupted and are in good electrical condition. The company owns 738 miles of the New York-Colon cable laid in 1907.

From March, 1881, to December 31, 1907, the receipts of the Mexican Telegraph Company were as follows: Gross, $10,782,182; expenses, $2,717,972; net profit, $8,064,210; dividends, $4,629,264; surplus, $3,434,946; invested in plant, $1,053,051; surplus, December 31, 1907, $2,381,895. There have been issued to shareholders as dividends full-paid shares amounting to $1,734,500. The operating expenses, repairs and renewals of the company for twenty-seven years have averaged about twenty-five per cent of the gross receipts. Dividends at the rate of ten per cent have been paid for the past twenty-one years.

The cables of the Central & South American Telegraph Company are 10,617 miles in extent. Three thousand three hundred and eighty-two miles were laid in 1882; 1,544 in 1891; 2,524 in 1893; 1,659 in 1906 and 1,508 miles in 1907. The receipts of the company from 1882 to December 31, 1907, were as follows: Gross, $21,247,405; expenses, $8,108,047; net, $13,139,358; dividends, $9,536,180; surplus, $3,603,178; invested in plant, $2,583,359; surplus December 31, 1907, $1,019,819. There have been issued to shareholders as dividends full-paid shares amounting to $2,732,800. Since 1897 dividends have been paid to shareholders at the rate of six per cent per annum.

The estimated report of the Central & South American Telegraph Company for the quarter ended June 30, 1908, gives gross of $408,000; expenses, $162,000; net $246,000; other income, $5,500; total income, $251,500; dividends, $143,565; surplus for quarter, $107,935; previous surplus, $1,172,712; total surplus, $1,280,647. The directors of the company have declared the regular quarterly dividend of one and one-half per cent, payable July 9 to stock of record June 30.

London Physical Society.

At the meeting of the London Physical Society, held at the Royal College of Science on May 8, Dr. C. Chree, president, in the chair, a paper on "A Modified Theory of Gravitation" was read by Dr. C. V. Burton. If we are to regard gravitational attraction as exerted through the medium of the ether, it appears to the author difficult to avoid the conclusion that the very great (or possibly infinite) velocity with which such attractions are propagated is due to the very great (or complete) incompressibility of the ether. This conception is embodied in the pulsatory theories of Hicks and of subsequent writers; the chief outstanding difficulty has lain in providing for that agreement of phase which must be assumed to subsist among the centres of pulsatory disturbance associated with the mutually attracting masses. This difficulty is avoided if we suppose that primary waves of compressional-rarefactional type are being propagated through the ether with a velocity enormously transcending that of light. These primary waves may be traveling in directions indifferently distributed, or predominantly or exclusively in one direction; but an essential point is that all effective wave-lengths should be very great, measured even by astronomical standards. Thus the pressure changes will be sensibly in the same phase over considerable regions, and if the ethereal compressibility is locally increased (or diminished) by the presence of electrically neutral matter, every particle of such matter will act as a centre of pulsatory motion.

For the electron, so far as concerns this modification of ethereal compressibility, a specification is assumed which involves no restraint on the free mobility of the electron through the ether. Incidentally the dynamics of the problem assumes a relatively simple form, and a value which could be quite insignificant attaches to a "gravitational (or non-electromagnetic) term" appearing in the expression for the total inertia of an electron. It has to be shown that, in its primary aspect, the assumed wave motion would give rise to no observable effects. This, in fact, follows from the assumptions made, and it is only through the feeble secondary effect of gravitation that any evidence of the wave motion could be obtained. In attempting to work out the theory on a numerical basis, values have to be found for a considerable number of physical quantities, several of these requiring to be independently conjectured, before the remaining quantities can be determined. But the range of the values which could be reasonably assumed is a good deal more restricted than might be supposed. The author gives a plausible set of values for these physical constants.

C. S. Whitehead asked if the amount of energy stored in the ether was greater or less than it was in the past.

Professor C. H. Lees asked if the ether considered was the old one or a new one. He referred to an interesting point in the author's representation of gravitation—namely, that matter was produced by the absence of something from the ether. In the theory advocated by Osborne Reynolds matter was produced by a deficiency in the normal piling, and recent theories seek to explain matter and gravitation by the absence of something which is present in free ether.

Dr. C. V. Burton, in reply to Mr. Whitehead, said he was not aware whether the amount of energy in the ether varied with time or not.

A paper on "An Examination of the Formulæ for the Grading of Cables" was read by Mr. C. S. Whitehead. In the *Journal* of the Institution of Electrical Engineers, of Great Britain, both M. O'Gorman and Dr. A. Russell have shown that it would be advantageous if cables for electric lighting were constructed so that the component of the electric intensity along a radius (in cylindrical co-ordinates) was kept constant for all points in the dielectric in the same plane perpendicular to the axis. They both find that to attain this object λr ought to be kept constant if the current is alternating, and σ/r constant if the current is steady, where λ is the specific inductive capacity, σ the specific resistance and r the distance from the axis. In this paper the question is regarded from a much more general point of view. Maxwell's two curl relations are taken in cylindrical co-ordinates, and it is supposed, as is quite legitimate, that the electrical and magnetic quantities are symmetrical round the axis, and that they vary as $e^{i(mz+pt)}$. We can then solve the equation, and from the continuity of the tangential components of the electric and magnetic forces obtain an equation to find m. If P is the component of the electric intensity along a radius, β the component of the magnetic force perpendicular to a radius in a plane perpendicular to the axis, we find

$$P = -\frac{im\beta}{\frac{4\pi}{\sigma} + \frac{\lambda ip}{c^2}},$$

where c is the ratio of the electrostatic to the electromagnetic unit of electrical quantity. Also if I be the total current in the wire parallel to the axis, and we neglect the displacement-current in the wire in comparison with I, we have $\beta = 2\,I/r$. Putting $m = -a + ib$, it is found that $\sqrt{a^2 + b^2} = \sqrt{\lambda}.h$, where h involves no quantities which have reference to the dielectric. Taking the real parts and putting P_0 and I_0 for the factors of P and I which are independent of the trigonometrical factor, we obtain

$$P_0 = 2\,I_0\, e^{-bz}\,\frac{c^2}{\lambda r}\sqrt{\frac{a^2+b^2}{p^2 + \left(\frac{4\pi c^2}{\lambda\sigma}\right)^2}}.$$

If we suppose I_0, a, b to be constants of the cable which do not vary as we vary λ or σ, we get the rules given by O'Gorman and Dr. Russell. Thus let σ be very great, then to keep P_0 constant we must make λr constant, but if $p = 0$, that is for steady currents, we must make σ/r constant. We have seen, however, that $\sqrt{a^2 + b^2}$ varies as $\sqrt{\lambda}$, so that in case σ be very great this process suggests the rule make $r\sqrt{\lambda}$ constant. When $p = 0$ it is shown that $a = 0$ and that b varies inversely as $\sqrt{\sigma}$, so that this case suggests the rule make $\sqrt{\sigma}/r$ constant. The equation for P_0 is, however, strictly true.

Dr. A. Russell complimented the author on his interesting paper and on the skill with which he had handled the mathematical equations. The question of the grading of cables was one of great importance to the electrical engineer, and it was necessary to attack it both from the mathematical and the experimental side. The author took the case of an infinitely long concentric main and assumed that the amplitude of the current remained constant. In the practical problem the main is of finite length and the amplitude of the applied voltage is constant. The mathematical difficulties in the way of getting a complete solution were great, and so he hoped the author would continue his investigations further. Dr. Russell exhibited a portion of a Jona graded cable which had successfully withstood a testing pressure of 150-kilovolts applied between the core and the lead sheath. If the dielectric had been air a disruptive discharge would have ensued at twenty-three kilovolts.

The Colorado Electric Light, Power and Railway Association.

The next annual convention of the Colorado Electric Light, Power and Railway Association will be held at Glenwood Springs, Col., September 16, 17 and 18. J. F. Dostal, 405 Seventeenth street, Denver, Col., is secretary and treasurer of the association.

Electrical Notes from Great Britain.

(From Our British Correspondent.)

IN the ELECTRICAL REVIEW for January 4, 1908, the writer gave an account of the progress that had been made with the Transcontinental Telegraph system of Africa. The length of telegraph line remains unchanged, being still 1,584 miles, and the deficiency between the cost of working and revenue continues to be advanced to the telegraph company by the British South Africa Company. There is, however, now a prospect that wireless telegraphy is going to render an important extension of the system possible. The German authorities are considering a scheme for installing wireless telegraphy in German East Africa. The telegraph company's northern terminus is at Udjidji, on the east coast of Lake Tanganyika, and if the German scheme makes co-operation possible, the company proposes to erect two wireless stations connecting Udjidji with Gondokouro, the southernmost point of the Soudanese telegraph, some 700 miles away. This would complete the Cape to Cairo system.

The Irish power scheme, the outstanding feature of which was the proposal to utilize peat as fuel, and to which reference was made in these notes a couple of months ago, when a parliamentary committee threw out the bill, has been again receiving attention. After its rejection it was ordered, in the House of Commons, that the bill be recommitted to the committee, and in a very much altered form it has now been reconsidered. As it now stands it is a far less ambitious proposal. The city of Dublin and important urban districts are excluded from its provisions, the capital powers are reduced by two-thirds to only $750,000, and the new designation is the Central Ireland Electric Power Bill. The peat-fuel proposition stands unaltered. The committee has passed the preamble and the revised scheme looks like going through.

The annual statement of our Controller of Patents shows that 29,040 applications for patents were received during 1907, and 16,272 were granted, and paid fees amounting to, roughly, $1,326,000, as compared with 30,030 applications in 1907, with only 14,700 granted, producing in fees $1,279,000. As to the trend of invention, there were signs that the great activity of the last few years in motor-car lines is falling off. If titles are a true guide there is a falling off of thirty-five per cent in motor road-vehicle patents. It appears that the occurrence of several serious railway accidents, owing to the failure of signals, turned attention largely to automatic electrical systems of signaling in which the services of signalmen are entirely dispensed with and the signals are given on the engine itself. Several applications were made for stopping trains automatically when the signals are against them. Further, owing to a number of lift accidents, inventors have been busy improving devices for preventing mine or other lift cages from falling should the hoisting cable break. In wireless telegraphy and the telegraphic transmission of portraits and designs there was also noteworthy inventive activity.

For Manchester Corporation electricity works extensions there have just been ordered a 6,000-kilowatt Zoelly turbine with Siemens three-phase alternator and a Contraflo condensing plant. The turbine will be built at the works of James Howden & Company, of Glasgow. The largest turbine of this type at present at work in this country is one of 2,000 kilowatts at Powell-Duffryn Collieries, at Aberaman, in South Wales. The last-completed turbo-alternator at Manchester was described in the ELECTRICAL REVIEW several weeks ago.

The electric-sign business in England is a small affair at present, but it is a direction in which there has been decided advance during the last winter or two. The best thing yet announced is the decision of all the principal tube and underground railways of London to place outside their stations large electric signs with the word "Underground." Altogether there will be some 700 signs of Hawkes' manufacture, the cost being more than $60,000. Each station is to have the "Underground" sign down the outside of the building, and outside either stations or booking offices there will be maps engraved on glass showing the routes followed by the different electric lines.

Lord Vaux of Harrowden, addressing shareholders the other day, told them that the Brush Electrical Engineering Company had had a record output during the year, but, owing to low prices, the profits were not commensurate with the business done. He added, however, that manufacturers were now beginning to hold out for better prices, which would at least give a reasonable prospect of a living profit being earned. Lack of working capital, the stoppage of the demand for tramcars, the unremunerativeness of motor-bus building, and other like misfortunes, formed chapters in his lordship's tale of woe. Tramcar inquiries for two years past had been so small that the company had been compelled to cultivate foreign markets, though they preferred home orders if they could be obtained at fair prices. At the same meeting Lord Vaux resigned his chairmanship, and E. Garcke takes his place. It is stated that a scheme for the reconstruction of Bruce, Peebles & Company, now in liquidation as already reported, has been prepared and has received the approval of committees of creditors and shareholders.

Arthur Wright, of demand-indicator fame, has, in his capacity as consulting electrical engineer to the Marylebone Borough Council, reported on the question of revising the present charges for electrical energy and the practicability of framing a tariff which could be applied universally throughout the borough. His observations are of special interest as bearing upon the present position of affairs. He concludes that it is "commercially inexpedient" to raise the average price per unit or to interfere during the present year with the option which the old "Metropolitan" consumers have of remaining on their original scale of charges. The whole question of electric lighting revenue is in a very critical state owing to the rapid introduction of metallic-filament lamps, and he says that the only chance of obtaining a revenue sufficiently large to meet the expenses of the undertaking is to encourage in every possible way the increase of the lighting business. The revenue this year will not warrant the council in running too great risks of the loss of business which might follow the compulsory change of tariff to 4,000 consumers, that being the number of those at present on the old "Metropolitan" scale.

The president of the Municipal Electrical Association, H. Talbot, the city electrical engineer of Nottingham (in which

place the four days' convention, concluded on July 3, was held), referred in his opening address to the continued apathy of assistant engineers, who do not take sufficient interest in the association to become associates or to compete for traveling studentships. There are more than 800 assistant engineers in the United Kingdom and only sixty-one have joined. This year no associate has contributed a paper and there is a decrease in their numbers. The reason is that they are unable to attend the conventions and they can read the papers in the press. Mr. Talbot thinks that it ought to be made possible for many of them to attend if they desired, seeing that the conventions are held in the summer when stations are working at their minimum output. Concerning metal-filament-lamp progress he says that any improvement in the "present extravagant methods of producing light must eventually prove beneficial to everyone." "For the time being it may go hard with contractors for electrical plants, as extensions will not be required so soon." Speaking of the city of Birmingham's announced intention to register wiring contractors who are authorized to carry out installations there, he said that registration would be a means of minimizing, though not preventing, bad and scamped work; it would tend to guard against "the deplorable ignorance of some of the electrical workmen of to-day." He advocated an entirely national scheme of registration carried out by the Electrical Contractors' or similar association. He suggested that it should be conditional on the gaining of a certificate for the passing of a fairly elementary examination on somewhat similar lines to that instituted by the Worshipful Company of Plumbers. Referring next to the subject of town's refuse as fuel for generating stations, Mr. Talbot said that incineration was an effectual and cheap way of getting rid of refuse, but "It is a certain fact, notwithstanding, that the handling and burning of the refuse alone costs more than the same output could be obtained for at the coal-fired generating station." The necessity for placing electrical undertakings in a sound financial position by establishing reserve and depreciation funds, the question of purchasing meters out of revenue, and the desirability of having uniformity of plant in a station, if it can be secured without sacrificing efficiency, were other matters briefly touched in the address.

The members then proceeded to consider a paper written from the councillor's point of view. The following day was given up to an excursion to Dovedale. Next day, July 2, and also July 3, the following papers received attention: "Considerations on the Design of a Generating Station," by H. Richardson, city electrical engineer, Dundee; "Reconstruction of an Electric Lighting Scheme with Observations on the Working of a Combined Steam and Water-Power Plant," by C. M. Shaw, chief electrical engineer at Worcester, where both types are at work; "'A.C.' Accumulator Substations, and the Use of Accumulators for Peak Loads," by A. M. Taylor, assistant electrical engineer at Birmingham; "The Work and Equipment of a Testing and Standardizing Department," by H. A. Ratcliff, of Manchester Electricity Works.

Toward the end of May an electric locomotive which was standing at Clapham Common Station of the City & South London Railway was found to be on fire, but it seemed at the time most unlikely that the cause was electrical. The matter was promptly investigated by A. P. Trotter, the electrical adviser to the Board of Trade, and his report is now issued. He says that there seems to be no evidence to show that the occurrence was due either directly or indirectly to the electric current, and that it is impossible to connect it with any electrical cause. He gives three possible causes, which are: (1) a lighted match thrown down by a man just before leaving; (2) the emergency oil lamp which may not have been extinguished; (3) spontaneous firing of oily waste in the cupboard. The fire seems to have burned most fiercely at the corner where the cupboard stands, and at the opposite corner where there was a considerable collection of insulated cables. The locomotive contents, including the controllers and other machinery above the floor level, were destroyed. The inside of the carriage next to the locomotive was uninjured, which circumstance leads Mr. Trotter to refer to it as a point in favor of separate locomotives.

The proceedings of the committee which is dealing with the London Electric Power bills continue to drag along. The case for the London District scheme has been most patiently heard. Perhaps the most important, or at any rate the most interesting, witness against the scheme was J. D. Falconer, a financial authority, who was, with Mr. Merz, practically the leader of the administrative schemes of 1905 and later, which failed. The chief point in his evidence was that showing why there had not been another Merz administrative scheme brought forward this year. He said that he and some others had come to the conclusion that while his 1905 scheme gave good promise of being profitable at that date, because of the backwardness of the existing authorities in catering for the power-user's requirements, the case was different to-day, for the companies had had several years in which to make up for their previous shortcomings. The case for the District bill was finished before the Whitsun vacation. On June 16, when the proceedings were resumed, the particulars of, and arguments for, the joint linking-up scheme of the eight existing companies were receiving consideration.

The report of the British Electric Traction Company, which has been awaited with some interest owing to the directors' announcement some months ago deferring the payment of preference dividend until the year's accounts were completed, has been published. The company has holdings to the tune of close upon $25,000,000 in electric tramway, lighting and power companies, of most of which it is the parent. On $10,000,000 of this (four and one-half per cent and five per cent debenture stock) interest is paid as usual. There next rank for dividend $8,100,000 six per cent cumulative preference shares —on these only three per cent can be paid this year; and all the ordinary shares, $6,600,000, again receive nothing, as was the case for 1906. The importance of making further provision for depreciation and of keeping ample funds in hand with which to "start upon new enterprises when opportunity offers" are the reasons for the position. Last year's bad weather was a hindrance to all tramway companies, and efforts to raise fares to more reasonable figures did not show effect early enough. Sixty of the British Electric Traction associated undertakings have federated for co-operative purposes under the British Electrical Federation. A building is now erecting in London where they will all have their head offices; they are purchasing stores collectively, have a mutual tramway insurance system, and in other ways secure co-operative economy. The report refers to the manifold difficulties placed in the way of conductors of electrical enterprises in Great Britain, and says that the directors are giving consideration to proposals for electrical enterprise submitted to them "from countries where the conditions for the investment of capital are more favorable than in this country."

ALBERT H. BRIDGE.

London, June 27.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

On First-Aid Work in Central Stations.

The author of this article, S. Lees, criticizes the arrangements ordinarily provided in manufacturing and engineering concerns for rendering first aid in cases of injury to limb or where an employé is suddenly taken ill. During many years' experience in central stations the writer has observed that almost utter indifference is paid to the most important question of ambulance equipment. In any works where there is running machinery accidents to employés are of frequent occurrence. Although these are mostly of a trifling nature if attended to at once, yet needless suffering is frequently caused by ignorance of unskilled persons and lack of proper appliances. It is not only in the matter of lack of provision of ordinary requirements for properly taking care of injured employés that central stations are at fault, but very often the safeguards are really added menaces to life and limb. It is the duty of managing authorities to see that a complete ambulance outfit is provided, and it is equally important that they insist on their workers being efficiently trained in first-aid work. Ambulance material should be carefully handled, and the materials employed should be kept isolated from any possible contamination. A first-aid box is described, together with the materials which should be secured for properly carrying out first aid.—*Abstracted from the Electrical Engineer* (*London*), *June* 19.

Distant Electric Vision.

In a communication A. A. Campbell-Swinton makes objection to Shelford Bidwell's communication on the subject of distant electric vision which was published in the issue of June 4. He points out that though, as stated by Mr. Bidwell, it is wildly impracticable to effect even 160,000 synchronous operations per second by ordinary mechanical means, this part of the problem of obtaining distant electric vision can probably be solved by the employment of two beams of cathode rays (one at the transmitting and one at the receiving station), synchronously deflected by the varying fields of two electromagnets placed at right angles to one another and energized by two alternating electric currents of widely different frequencies, so that the moving extremities of the two beams are caused to sweep synchronously over the whole of the required surfaces within the one-tenth of the second necessary to take advantage of visual persistence. So far as the receiving apparatus is concerned, the moving cathode beam has only to be arranged to impinge on a sufficiently sensitive fluorescent screen and give suitable variations in its intensity to obtain the desired result. The real difficulties lie in devising an efficient transmitter, which, under the influence of light and shade, shall sufficiently vary the transmitted electric current so as to produce the necessary alterations in the intensity of the cathode beam of the receiver. Possibly no photoelectric phenomenon at present known will provide what is required in this respect.—*Abstracted from Nature* (*London*), *June* 18.

The Kearney High-Speed Railway.

On June 13 a public demonstration was made of the model high-speed railway designed by E. W. C. Kearney, at Aldwych, England. This is a system in which the cars are run on a monorail laid on the ground, and are steadied by wheels running under an overhead rail. The centre of gravity of the car is kept low by the motors, and the pressure on the top guide rail is therefore not very considerable. On curves the position of this rail is altered to suit the speed at which the train is intended to travel, and is more strongly supported. The inventor claims that derailment is impossible. It is in tube railways that he hopes first to apply the principle. In such cases a rigid support for the top guide rails is provided by the roof. It is also proposed to do away with the necessity of elevators by bringing the trains to a platform just below the street level, from whence the train will run down a gradient of one in seven, so that within twenty seconds of leaving the platform a speed of fifty miles an hour will have been reached. During this time it is stated that passengers will be unconscious of sitting on an inclined plane, owing to the forces due to acceleration exactly counterbalancing the effect of the gradient. For bringing the train to rest it is to ascend a similar gradient of one in seven to each station, so that braking is apparently done away with. Mr. Kearney claims that the cost of tubes built on his system will not exceed £250,000 per mile, as compared with £500,000 per mile for ordinary tubes. A scheme has also been sketched for applying the system to elevated street railways. The scheme meets with little encouragement, and it is not expected that much will develop as the result of these experiments and tests.—*Abstracted from the Electrician* (*London*), *June* 19.

The Electric Lighting of the Rotherhithe Tunnel.

On Friday, June 12, the Rotherhithe tunnel was formally opened by the Prince and Princess of Wales. The new tunnel, undertaken in 1904 by the London County Council, links up the districts on the north and south of the Thames between the Tower bridge and the Blackwall tunnel. The work was carried out to the designs and under the supervision of Maurice Fitzmaurice, chief engineer to the London County Council. The tunnel under the river is 1,571 feet long, and the approach tunnels, cut-and-cover work, and open approaches, make a total length from entrance to entrance of 1.3 miles. The tunnel is thirty feet in diameter outside the lining, the gradients at the end portions being one in 36.5. The central under-river length has a grade of one in 800. Four shafts, sixty feet in diameter, are provided, two on each side of the river, and in two of them are spiral staircases leading to the surface. The electric lighting is on a generous scale. Three rows of metallic-filament lamps run all through the covered portion of the works, the lamps being of thirty candle-power placed thirty feet apart. The candle-power provided works out at one-eighth candle per square foot. There are altogether 631 thirty-candle-power lamps and 108 fifty-candle-power lamps, the latter being used mostly in the approaches, domed shafts, etc. The London Electricity Supply Company and the Bermondsey Corporation furnish the supply. The former is alternating current at 110 volts, and is used for lighting, and the latter is direct current at 480 volts, and is used for the pumping machinery. Both supplies are made available for both purposes by the

use of motor-generators. In the event of failure of the lighting supply two thirty-kilowatt motor-generators are automatically started up on the direct-current supply, and within twenty seconds of failure the lamps will be lighted by the current generated by using the Bermondsey supply. In a similar manner, the failure of the supply for the pumps is guarded against, a twelve-kilowatt set being provided in this case, working with current from the London Electricity Supply Company and generating current for the pump motors. For handling storm water flowing down the approaches and the drainage from the washing down of the roadway, three electrically driven pumps are installed, each of 200 gallons per minute capacity against a head of seventy feet. One of these pumps is held in reserve.—*Abstracted from Engineering (London), June* 19.

The Centre of Gravity of Steam and Electric Locomotives.

W. H. Booth, the author of this article, holds that in their studies of electric locomotives electrical engineers have paid too little attention to what has already been accomplished or thought out in the past or forced upon the notice of engineers by the immutable laws of mechanics. In actual practice, the centre of gravity being about sixty inches above the rail, the angle of pressure of the resultant of any swaying movement of the centre of gravity is almost exactly sixty degrees. The tendency to force outward the rails is much reduced as compared with the tendency of the low-centre-of-gravity engine to do so. It has been argued that with a high centre of gravity an engine tends more easily to overturn, but while this may be the case it should not be forgotten that in rounding a curve the lateral tendency of the centre of gravity is to press the outer wheel more firmly down upon the rail, whereby its flange is restrained from mounting the rail. Were it not for this increased pressure the wheel would more easily mount the rail and run off. When an excessive speed is run around a curve either the engine will run off the rail or it will turn over. To check one tendency is to increase the other. Designers would do well to abandon the low centre of gravity. Much help would be given by raising the whole of the motor. Direct-connection, it is true, is much valued, but it may well be wondered if too big a price has not been paid for the abolition of the gears. This price has been the use of very small wheels, the necessity for very large motors, and the fixing of the centre of gravity very low, a lowness that has been accentuated by the absence of the boiler. In the steam locomotive all the moving parts and the cylinders and valves are practically at the level of the axle centre, and only the boiler remains to produce even a height of five feet. A first-class geared electric locomotive constructed in a steam-locomotive shop would prove that the geared electric locomotive is not, after all, of necessity a poor contrivance. It would enable radical differences of design to be introduced and put a stop to the necessity which at present seems to be paramount of the small wheel. Even with the best of design, assuming that the geared system proves all that can be desired or anticipated, it is not likely that the centre of gravity of the whole machine can be raised as high as it is in the steam engine, unless special highly placed weights are added for the purpose, and this is undesirable, as, indeed is all redundant weight. The weight of the motor parts should not come upon the wheels except through the intermediary of springs. This complicates the problem of gearing, but a solution seems possible in the direction in which it has been solved by the makers of traction engines, wherein a form of Oldham's coupling seems to give satisfaction in solving the difficulty of the gear centres.—*Abstracted from the Tramway and Railway World (London), June* 4.

The Electrical Installation at the New Public Offices, Whitehall, England.

The new block of public offices at the southern end of Whitehall, England, which will be the home of the local government board and the board of education, and later of the board of trade, has been practically completed. The lighting installation includes over 6,000 lamps. The building is supplied jointly by the Westminster and the London Electricity Supply corporations. The former supplies current for power and lighting and the latter for lighting only. The installation scheme provides for two pairs of service cables from each company's mains at different parts of the building, and there will be four separate main switchboards at these intake points. The Westminster supply is three-wire, direct current, 400 volts across the outers, and each main switchboard is divided into two halves, the 200-volt lighting circuits being balanced on each side of the three-wire system. The London company's supply is alternating. Two feeders supply two sets, each of three forty-kilowatt, single-phase transformers in parallel, these sets being in different parts of the building. These transformers step down the voltage from 2,500 to the lighting pressure of 200. Transformers are in a fireproof chamber adjoining the room containing the main switchboard. The handle of the high-tension, oil-break switch projects through a slit in the wall, so that the transformers can be isolated from the high-tension mains or changed over from one pair of cables to the other without entering the transformer chamber. The transformer chamber and main switchboards are situated in the basement proper, and from the four main boards 1,000-ampere flexible rubber cables lead down through openings in the floor of the subbasement. The cables are lead-covered, paper-insulated, and the joints between these and the short lengths of rubber cable are enclosed in specially designed ceiling boxes, one for each cable. From the 1,000-ampere cables 250-ampere cables run up to the submain boards in the basement. The iron troughing widens out where the cables enter the junction boxes, to the sides of which the troughing is bolted. There are about a dozen of these submain boards, each containing a double-pole switch and eight double-pole porcelain enclosed fuses. The boards are set into the eighteen-inch wall, and the backs of the boards are accessible from the other side of the wall. From this point the wiring is entirely in three-quarter-inch galvanized-steel seamless conduit. The fittings in the corridors and rooms are all hung on gimbals from the ceiling. Ceiling rose blocks are arranged in the centre of the rooms, so that a single electrolier or five separate flexible leads can be brought through ceiling eyes to separate counterweight lamps. All rooms are well provided with wall plug sockets, which are flush with the wainscoting and are not screwed onto the wood blocks sunk in the wall, but are sprung into brass rings attached to the blocks. Four handsome standards supported on marble pillars illuminate the grand staircase. The lamps are all 200-volt carbon-filament lamps, mostly of sixteen candle-power, a few eight-candle-power lamps being used in the corridors. Four thousand of the lamps are counterweight lamps, and there are over 1,000 wall plugs for table lights, etc. For the telephone service there will be two exchange rooms, and night telephones in several rooms on each floor will admit of direct communication to the hall porter. The elevators for the lifting of paper are electrically driven with push-button control. These can hoist one hundredweight at the rate of 120 feet per minute.—*Abstracted from Electrical Engineering (London), June* 18.

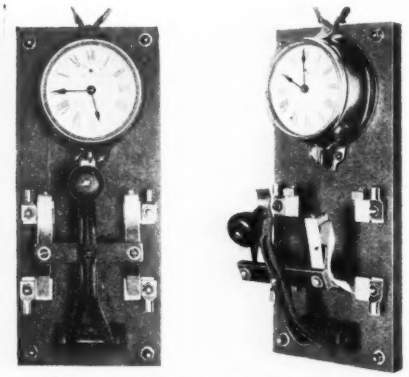
INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

IN THE following pages there will be found descriptions and illustrations of a large variety of apparatus which enters very extensively into the work of the electrical contractor. There has been a good deal of inquiry concerning the attitude of manufacturers with regard to the introduction of new appliances and the improvement of appliances for years well known in the electrical field. A great many of these devices are shown for the first time. It may be well, in passing, to state that no such eagerness to come strongly before the contracting fraternity as is evident at this time has been indicated for several years. Subsequent issues will contain further descriptions of apparatus used in this field.

The "Security" Automatic Time Switch.

In connection with the prevailing idea of increasing the hours of store lighting, contractors have frequently, within the last few years, been called upon to supply some means of arranging for the switching off of the lights in a store window or, in fact, in the store equipment proper, at a predetermined time. In many of the larger cities this is accomplished by patrolmen, and it is part of the central station's work to see to it that the lights are not burned longer than the hour for which the contract is executed. In isolated cases, where the services of a watchman are not available, or where this periodic attention would cost too much, the automatic time switch fills the bill very nicely. In many cases, however, where the time switch is of elaborate construction, employing a multiplicity of contacts and an expensive clock movement, even the cost of this equipment makes it prohibitive. Where a cheap, simple, reliable and durable time switch can be secured, there is a considerable margin of profit for the contractor in handling and installing such a device.



"Security" Automatic Time Switch with Cover Removed.

The F. Bissell Company, 226 Huron street, Toledo, Ohio, has placed on the market the "Security" automatic time switch, illustrations of which are shown herewith. This is an automatic circuit-breaker switch with an auxiliary carbon break. It operates by gravity and has no spring construction. It is impossible for the blades to stick. The back is flush, and all mechanism is on the face in plain sight. The switch is furnished for either on or off use, or for a combination of both.

"Security" Automatic Time Switch with Cover.

Western Electric Company Direct-Current and Alternating-Current Motors.

Of particular interest to contractors are the direct-current motors of the "E" and "I" design, and the alternating-current motors of the "CP" design, manufactured by the Western Electric Company, Chicago, Ill. The "E" design comprises a line of motors ranging in size from one and one-quarter to seventy-five horse-power. These motors are furnished either open, closed with grids, or completely encased, depending on the conditions under which they must operate. The field-poles are made up of laminated steel securely bolted in place. The armature core is of a special grade of steel laminations which are carefully annealed after punching and treated with a coat of japan, insuring the lowest possible core loss.

Two Horse-Power Motor, "I" Design.

The machines are furnished for either horizontal or vertical operation, and the bearing brackets of the horizontal machines may be shifted so that the motors can be suspended from the ceiling or walls wherever this is desirable. Especial care has been taken in the design of the brush rigging so as to insure the best brush contact and adjustment. The bearings are made especially large and strong, insuring cool operation and economical wear.

The line of small direct-current motors

Open Type Motor, "E" Design.

of the "I" design range in size from one-half to two horse-power. In the design of these motors special attention has been given to produce a motor that will be absolutely reliable in operating under the adverse conditions to which small motors are commonly subjected.

The frame and field-poles are made of a single casting of high permeability. By this construction all air-gaps, except those between the armature core and pole-faces,

have been eliminated. The commutating field is made especially stiff, insuring sparkless operation for wide variations of load and speed. The bipolar type is used to prevent flashing under sudden and wide variations of load to which these motors

INDUCTION MOTOR, "CP" DESIGN.

are commonly subjected. The field coils are placed in an inclined position, so that the air currents set up by the rotation of the armature are met at all points by surfaces inclined to the direction of their motion. This feature accelerates the circulation and aids in the rapid distribution of heat generated under overloads.

The alternating-current motors are furnished either with squirrel-cage or phase-wound rotors, depending on the nature of the work they are to perform. The stator frames are of cast iron in one piece, and the section is such as to obtain the most rigid support for the laminations. The feet are broad, and the entire frame is so constructed that there can be no springing or vibration. Exceptionally high efficiencies and power-factors have been obtained for these motors by a special form of winding, liberal design, and by using the best grade of material throughout. All bearings are self-aligning and of the oil-ring type, and are housed in brackets of ample size to withstand the maximum capacities of the machines.

Some G & W Electrical Specialties.

The G & W Electric Specialty Company, 128 West Jackson Boulevard, Chicago, Ill., is calling attention to a number of time-saving, money-saving and trouble-saving specialties for central stations. Several of these specialties are illustrated herewith.

The type "MO" porcelain pothead is made up with single conductor tubes mounted in an iron case and with caps having one-inch holes. The lower casting is slipped over the cable and the lid and caps over the conductors. The conductors of the cable are separated, the joint is made, and the lower casting brought up in place, filled with compound to one and one-half inches from the top, and the lid set in place with the separated conductors passing through the tubes. The bottoms of the tubes are closed around the conductor by tape, and the tubes filled with compound to within one-half inch from the top. The caps are then drawn down into place and the conductors well taped down on the cap and several inches along the conductor. A few inches of braid on the wire is removed where it enters the cap, so that it will not act as a wick to lead water into the pothead.

The type "TS" porcelain pothead is a single-conductor, detachable pothead for high-tension and high-current duty. There are three porcelain members. The intermediate member provides a means of turning a threaded taper collar which

TYPE "MO" PORCELAIN POTHEAD

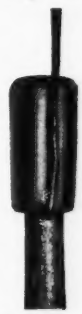
MULTIPLE-CONDUCTOR STATION TYPE POTHEAD.

TYPE "TS" PORCELAIN POTHEAD.

TYPE "S" PORCELAIN POTHEAD FOR HIGH VOLTAGE.

draws the two metal members together through the medium of the taper-headed plug and an externally threaded socket, thus insuring a tight-fitting joint. The standard size is designed to carry 650 amperes. This type of head is recommended when the disconnecting feature is required for loads above 150 amperes.

This type of pothead is well adapted to street railway work, as it will carry heavy currents, can be mounted on a pole without any protection from the weather, and can be disconnected under load by using ordinary precaution.



G & W GROUND-PIPE CAP.

The multiple-conductor stationary type of pothead has been developed to meet the demands for a station bell which is easy to install, low in first cost, and reliable. This head consists of a porcelain bowl and cover. The bowl is approximately seven inches in diameter at the top and four inches at the bottom. The bottom of the bowl is fitted with a metal plate provided with a collar drilled and tapped to size to screw upon the cable. The lid fits into the top of the bowl and is provided with the required number of holes and short tubes through which to pass the conductors. Owing to the manner in which the inside top edge of the bowl is cut away, the lid can be sealed into the bowl, thus excluding dust and moisture from inside the bell.

The G & W ground-pipe cap consists of a hollow galvanized malleable casting internally grooved along one side and so shaped at the mouth that the end of the ground wire can be introduced into the casting along the groove. The cap, with the wire in place, is put upon the top of the pipe and the pipe driven. In driving the pipe the cap is driven on and the copper wire wedged in securely between the inside wall of the cap and the outside of the pipe. The cap protects the top of the pipe from being battered out of shape, and saves the time required to cut off the battered end, as is often necessary in driving pipe in hard soils, and makes a joint of good conductivity between the ground wire and the pipe.

Oneida Galvanized Chain for Arc-Lamp Suspension.

One of the most important products turned out by the hardware department of the Oneida Community, Limited, Oneida, N. Y., is the Oneida galvanized chain. This is made in two sizes: No. 1, for suspending arc lamps, and No. 5, for suspending incandescent lamps. These chains can be used for any standard mast-arm. The chain is heavily galvanized and rust-proof. The fact that ice or sleet does not interfere with its ease of operation has been strikingly demonstrated at Niagara Falls, where a certain lamp was close to the cataract and the chain subjected not only to all conditions of weather, but to a continuous deposit of mist arising from the falls. The Buffalo & Niagara Falls Electric Company reported that the chains on this system worked perfectly throughout the entire winter in spite of the severe conditions.

The Wakefield Standard Universal Lighting Fixtures.

The F. W. Wakefield Brass Company, Vermilion, Ohio, has placed on the market one of the greatest boons to electrical contractors in the Wakefield standard universal lighting fixtures. Recent developments in the art of electric lighting have made necessary the design of special fixtures, requiring large investments in order to carry a necessarily extensive line of designs. The adaptability of the Wakefield universal fixtures eliminates the necessity of carrying a large number of assembled fixtures, as it is possible by proper selection of stems and arms to adapt the Wakefield "body" to fit any requirement.

WAKEFIELD PATENT BODY.

WAKEFIELD CURVED ARM.

WAKEFIELD STRAIGHT ARM.

CLUSTER MADE WITH WAKEFIELD ADJUSTABLE FIXTURES.

Not only is it true that Wakefield fixtures are peculiarly adaptable to nearly all of the special needs of the trade, but it is also true that the principles of construction that are followed in building up these fixtures are such as will save the dealer and contractor much time and labor in assembling and installation.

As may be seen from the accompanying illustrations, the solid body contains no nipples whatever, and there are no inner iron bodies. A special feature which characterizes the arms and stems is that they all have a steel fish wire drawn through them, which allows the fitter to wire the arm in a very short time.

Hexagon arm backs on each arm permit the use of a wrench, removing the possibility of unsightly marks which are often left on the arms by the use of pipe pliers.

The body can be used for either two, three or four-light arm fixtures with a special provision that a light may be added to the bottom of any one of the fixtures. This feature, with the universal arms manufactured by the company, permits any style of arm on any style of stem with the various styles of plain, scroll and straight arms.

For each body either snort or long stems are made for the construction of ceiling lights.

The arms and stems are made of heavy gauge stock finished in rich gilt, brushed brass or oxidized copper.

The cluster canopies are particularly important in making up special designs. These canopies are constructed of a heavy plain shell which is reinforced on the inner side by a casting, being fastened to the inner surface of the shell. The shell and castings are then drilled and tapped for either a one, two, three, four or five-light fixture. These outlets are fitted with small brass plugs which, when the shell is finished up, are left in the holes. The accompanying illustrations show a few of the many forms in which these fixtures may be assembled.

The Pettingell-Andrews Type D-2 Remote-Control Switch.

The Pettingell-Andrews type D-2 remote-control switch for either direct or alternating current has been designed along the lines of modern circuit-breaker construction, with laminated copper brushes and locking parts that are not called upon to carry current, and the entire mechanism is built up on a one-piece iron frame, so that neither rough handling in shipment nor constant pounding of operation will cause the fixed and moving parts to get out of alignment. The meritorious features of this device are well shown in the accompanying illustration.

The design of this switch precludes the possibility of the mechanism not completing its intended movement, either through a fall in the potential of the actuating circuit or due to too short a duration of the opening impulse or a careless manipulation of the control button. The switch is so assembled that it will fall open by gravity unless it is locked closed. There is no half-way point for it to hang. It is either locked closed by a steel-jointed toggle, hanging wide open, or traveling very fast toward one or the other of these positions.

PETTINGELL-ANDREWS TYPE D-2 REMOTE-CONTROL SWITCH, OPEN.

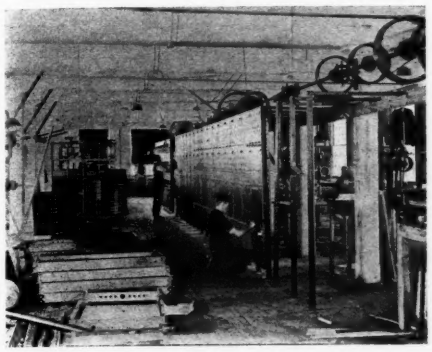
Some years of experience with arc-lamp cutouts enter into the design of the auxiliary break, and the operating current is broken with absolute certainty as the switch completes its closing movement.

These switches are made in the following capacities: Type D-2 are made with two, three or four poles up to 2,500 amperes, 250 volt, air-break, and 250 amperes, 2,500 volt, oil-break. Type D-3 and type D-4 are made for twenty-five amperes, 250 volts only.

This switch is made by the Pettingell-Andrews Company, Boston, Mass.

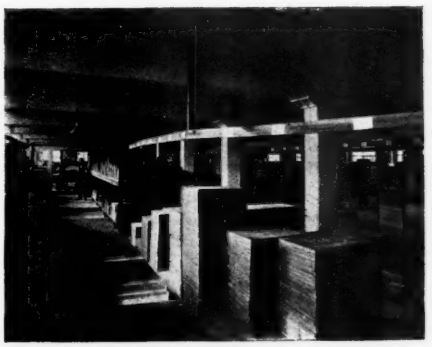
The Trumbull Electric Manufacturing Company.

Upon several occasions, so rapid has been the growth of the Trumbull Electric Manufacturing Company, of Plainville, Ct., as a switch specialist, it has been our pleasure to illustrate and describe in these columns the development of the company



SWITCHBOARD DEPARTMENT OF THE TRUMBULL ELECTRIC MANUFACTURING COMPANY.

by text and with illustrations. At the present time this exploitation will suffice as far as the company's progress in the knife-switch field is concerned. There is another department, however, which is not so well known because it is of more recent development, namely, the panel-board and switchboard department. During the last year the growth of this department has equaled or even surpassed the record made



SLATE STORAGE DEPARTMENT OF THE TRUMBULL ELECTRC MANUFACTURING COMPANY.

in the development of knife switches. Last summer, when the company's new factory was erected, it was intended to turn over about one-half of the four-story building, with about 22,000 square feet of floor space, to the panel-board and switchboard department. During the year, in spite of the market depression, this department has grown to such an extent that within a short time practically the entire building will be necessary for panel and switchboard work.

Familiar as the field is with the company's line of panel-boards, it is doubtful whether the great majority is acquainted with the extent to which these boards are used. A year ago the company's panels were ordered by the dozen; to-day they are sent out by the hundred, and cover every imaginable specification.

Last fall the department was entirely reorganized, and electrical engineers and assistants and other employés were recruited from the factories of some of the largest switchboard builders in the country, and a large number of successful bids were made for both government work and isolated plants.

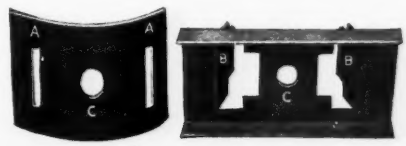
In entering this field the company realized the necessity of a thorough equipment to cover the most difficult specifications, and thousands of dollars have been spent in preparing to meet these requirements.

The company will shortly publish a list covering standard direct-current and alternating-current switchboard panels. There will be five distinct lines, covering specifications with and without circuit-breakers, with and without motors, and including complete economic arrangements for both central stations and isolated plants. With the line which the company will develop it will be possible for engineers to effect combinations to cover any kind of general requirements found in engineering practice. These boards will be kept in stock and can be shipped immediately.

Three Important Line-Construction Specialties.

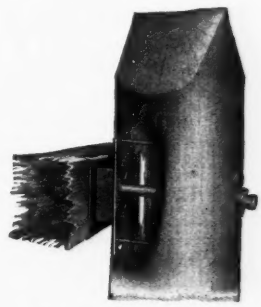
The Belden Manufacturing Company, 194 Michigan street, Chicago, Ill., has for a long time been favorably known as the manufacturer of a line of magnet wire and telephone cords. Recently the company has commenced the manufacture of several new patented devices for line construction work.

The Belden steel gain is a comparatively new device, although the construction departments of electric light, telephone, telegraph and power-transmission companies have seen the need of such a device for some time. The Belden wire test clamp or test connector has many advantages over the older forms of test clamps. The third device is known as the Belden ground clamp. This clamp possesses three features which particularly appeal to the user, namely, maximum strength, minimum price and great adaptability. One size fits all sizes of pipes. The steel gain is a steel support for the cross-arm which saves cutting gains in the pole and obviates the necessity of cross-arm braces except on longer than six-pin cross-arms. Referring to the illustrations herewith,



COMPONENT PARTS OF BELDEN STEEL GAIN.

two tongues, B B, are cut from the back of the steel gain and these tongues inserted in the slots, A A. These are forced into the pole when the bolt is set up. The bolt passes through the cross-arm, the steel gain, and the holes, C C, and through the pole. This squares the cross-arm with the pole, fastening it securely in place. For power-transmission



BELDEN STEEL GAIN.

construction work extra heavy steel gains are made.

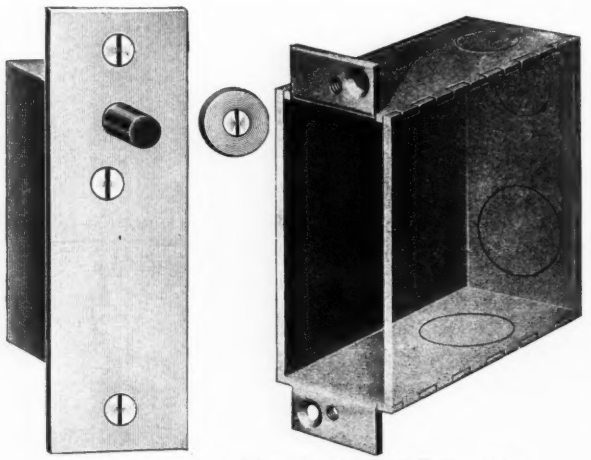
The use of the Belden wire test clamp is easily seen from the accompanying illustration. Essentially the device consists

BELDEN TEST CONNECTOR.

of a flat plate fitted with a slotted brass screw. The wire is placed in the slot in the brass screw and held in place by copper plate or leaves, one wire being placed between each pair of leaves and secured by a nut. The slot in the brass screw is large enough to receive any ordinary telephone or telegraph wire.

The "H. & H." Automatic Door Switch.

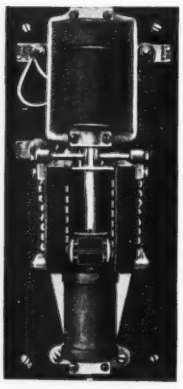
The accompanying illustrations show the automatic door switch and containing receptacle which has been placed on the market by the Hart & Hegeman Manufacturing Company, Hartford, Ct. This door switch will not only automatically operate the light, but is is so arranged that it automatically adjusts itself during the different seasons of the year to accommodate its action to the swelling or shrinking of the door.



H. & H. Automatic Door Switch and Receptacle.

Ward Leonard Motor-Starters.

The apparatus made by the Ward Leonard Electric Company, Bronxville, N. Y., have always been of great interest to contractors. This company manufactures so many devices which enter into installations of every character and size that its name has long been familiar to the contracting fraternity.

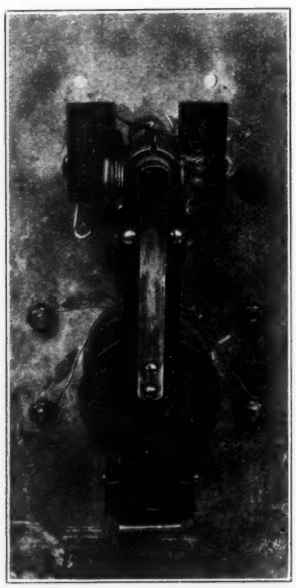


Ward Leonard "AS" Motor Starter.

Tank Switch for Open Tank System.

The company announces recent advances in the design of automatic motor-starters and devices for regulating them, namely: Push-buttons, pressure regulators, tank switches, etc. Among the devices to which particular attention is called at the present time is the "AS" type motor-starter. This is a self-starting rheostat with a no-voltage release. This starter is for use in small sizes with main-line tank switches, and in any size with start and stop push-buttons. One of the illustrations herewith shows a self-closing switch operated by push-buttons. The combination of this switch and the "AS" starter, when mounted on one panel, forms a "CS" type self-starting rheostat with no-voltage release, equipped with a self-closing switch and a protective interlock, preventing the closure of the self-closing switch except when the resistance-controlling element is in the "all resistance in" position.

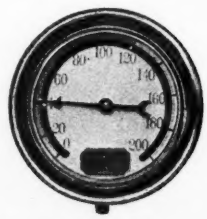
The "CS" type starter, when used with the pressure regulator, an illustration of which is shown herewith, is adapted to motor-driven pumps, etc.



Self-Closing Switch Operated by Push-Button.

The special feature in the design of this special line of apparatus is that the resistance units consist of Ward Leonard enameled units, the resistance element being thoroughly protected from any mechanical, electrical or chemical depreciation.

The self-starter is truly aligned, all the machine work being done at one time,



Pressure Regulator.

positively assuring that the dash-pot, plunger and magnet core are in perfect alignment. The company is giving the utmost attention to these details, and maintains an enviable position in the market by the honesty of the claims which it makes for its apparatus.

Minerallac Conduit and Cable Hangers or Cleats.

The accompanying illustration shows a cable and conduit hanger which has been placed on the market by the Minerallac Company, Monadnock Block, Chicago, Ill. These hangers are made of the best spring steel, and are easily and quickly put in place. Open wiring conduit and cable may be run with great rapidity and very compactly arranged. The hangers have been approved by the Underwriters' association for use on circuits up to 300 volts, when mounted direct on the surface

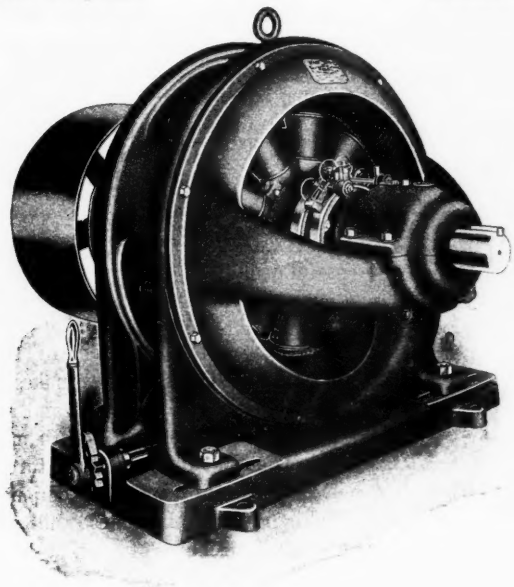
Minerallac Conduit and Cable Hanger.

wired over. For voltages from 300 to 550 the hangers must be installed with spacers under the base of the hanger or mounted on metal racks or brackets so as to hold the conductors at least one inch from the surface wired over. For voltages above 550 the hangers should be used with an appropriate insulating bushing having necessary insulation and dielectric strength, the hangers being mounted on metal racks or brackets to hold the conductors far enough from the surface wired over to preserve the required electrical clearance.

The company is prepared to furnish all styles of these bushings for high-tension work, properly designed to afford the necessary insulation and mechanical strength.

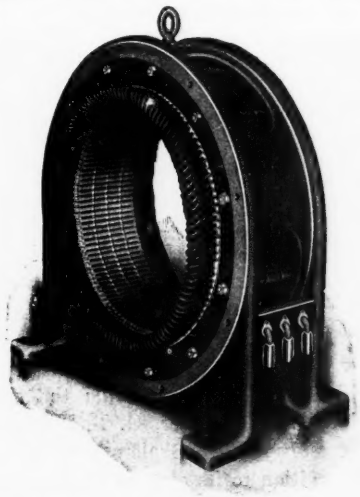
Fort Wayne Multi-Phase Belted Alternators.

The Fort Wayne Electric Works, Fort Wayne, Ind., has placed on the market a new line of multi-phase, sixty-cycle, revolving-field alternators of the belted type. These are styled TRB three-phase and QRB two-phase.



FORT WAYNE TYPE TRB THREE-PHASE BELTED ALTERNATOR.

These alternators are cheap, not through lack of material or through poor workmanship, but because of the reduced number of poles and the resultant speed, which permits the use of the minimum amount of material needed for the given output. The material is all of the highest quality,



FRAME OF FORT WAYNE FORM B ALTERNATOR WITH ARMATURE WINDING.

and is handled by the most approved methods. The bearings are ample and cool-running, provided with oil-rings and reservoirs of ample capacity. They are supported by tripod brackets cast upon the end shields, giving great rigidity, with free access to the collector rings. The general appearance of this machine is well shown in the accompanying illustrations.

The alternator frame is of cast iron, in two parts, accurately machined and bolted together through the laminations of the armature core. The laminations are in sections and of special shape, having inwardly projecting teeth and projections extending out from the usual symmetrical outside circumference. In these projections are punched the holes through which the bolts pass, clamping the core and the two halves of the field frame firmly together. Air spaces are provided at the ends of the core and between laminations at regular intervals, to take advantage of forced ventilation produced by the fanning effect of the revolving field when the machine is in operation. An additonal advantage is taken by having the entire outer surface of the core exposed to the air.

The coils are carefully wound with highest-grade copper and insulated by superior methods of insulation. They are held in place by wooden wedges driven into grooves in the slots.

The revolving field of the form B alternator is made up of a number of poles fitted into a central laminated spider with a dovetailed joint and taper keys to hold them firmly in position. After the poles are inserted in the special spider, end plates are bolted to each end of the core, closing up the joints. The poles are built up of laminations punched accurately from high-grade material and assembled under pressure.

The collector rings are made of cast iron and have ample carrying capacity. Carbon brushes are used, held by the most improved type of brush-holder.

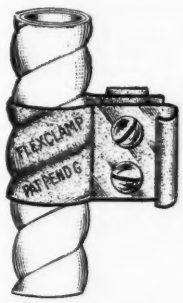
The form B multi-phase belted alternators are made with either two-phase or three-phase windings, for 2,300, 1,150, 600, 480 and 240 volts.

Belted exciters are furnished for all form B alternators. These exciters are known as the Fort Wayne type ML, and are belted to a small pulley mounted on an extension of the alternator shaft on the collector end.

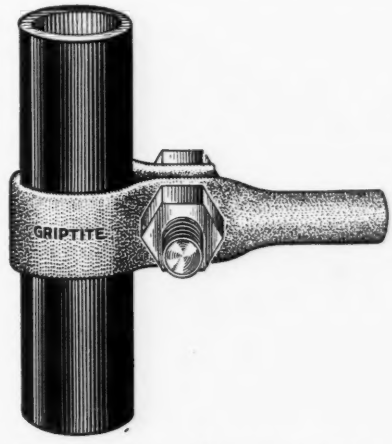
REVOLVING FIELD OF FORT WAYNE FORM B ALTERNATOR.

Ground-Connection Clamps.

The Novelty Electric Company, 50-54 North Fourth street, Philadelphia, Pa., is calling attention to its "Griptite" and "Flexclamp" ground-connection clamps. The "Griptite" ground-connection clamps are for rigid conduit, and are made of rolled copper tubing in sizes to conform to the exact diameter of standard pipe from one-half to four inches. Being made of one piece of copper, the tightening of the bolt insures a perfect electrical contact



"FLEXCLAMP" GROUND-CONNECTION CLAMP.



"GRIPTITE" GROUND-CONNECTION CLAMP.

at all points on the pipe. The clamps have rounded edges, so that no possible injury can result to the lead casing of the cables when used for grounding these. The hollow tube to which the ground wire

is soldered takes any size of copper wire up to and including No. 4 Brown & Sharpe gauge.

The "Flexclamp" is used for grounding Sprague flexible conduit and BX conductors. These clamps are made to fit perfectly the helical construction of the conduit. They are made of one piece of copper, and the tightening of the bolts insures a perfect electrical contact. There are five sizes—Size A, for No. 14 and No. 12 BX-2 conductors, No. 14 BX-3 and three-eighth-inch flexible conduit; size B, for No. 10 BX-2 and 3 conductors, No. 12 BX-3, No. 12 and No. 14 BXL, and No. 12 and No. 14 BM conductors; size C, for one-half-inch flexible conduit; size D, for three-quarters-inch flexible conduit, and No. 4 BX-2 conductor; size E, for one-inch flexible conduit.

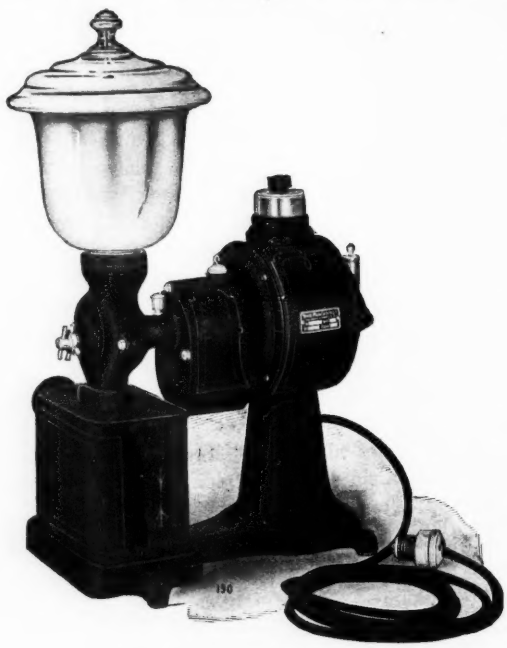
The Safety Armorite Conduit Company.

The Safety Armorite Conduit Company, Pittsburg, Pa., is the sole manufacturer under United States patents of "Loricated" and "Galvaduct" iron-armored conduits for interior construction. These conduits have found a very wide use in construction work of every character in all parts of the country. Among the important buildings in which these conduits have been exclusively installed are the following: Marshall Field Building, Commercial National Bank Building, Chicago, Ill.; Washington Terminal, Baltimore & Ohio and Pennsylvania Lines, Washington, D. C.; City Investing Building, Trinity Corporation and Annex, Hudson Terminal Buildings, Hotel Plaza, New York city; Carnegie Institute and Library, Pittsburg, Pa.; H. H. Rogers Memorial Church, parsonage, parish house and high-school group, Fair Haven, Mass.; Naval Academy buildings, Annapolis, Md.; Salt Lake Security and Trust Company Building, Salt Lake City, Utah; Denver Dry Goods Company, Denver, Col.; United States Military Hospital, Presidio, Cal.; Singer company's factories, Elizabethport, N. J.

In addition to the widespread use of these conduits in this country they have been exported for use in England, Canada, Australia, New Zealand, West Indies, the Philippine Islands, Hawaiian Islands, Mexico and the South American republics. These conduits are also installed in the majority of the warships of the United States built in recent years and in a large number of pleasure and merchant ocean-going vessels.

The Diehl Electric Coffee Mill.

The Diehl Manufacturing Company, Elizabethport, N. J., to meet a general demand for an electric coffee mill adapted to the needs of grocers, hotels, boarding houses and other users of coffee in large quantity, and which could be sold at a low price, has produced a low-priced electric coffee mill which at the same time is reliable, efficient and economical. As a maker of first-class electrical apparatus the company needs no introduction. Its large experience in the manufacture of thousands of small motors for driving fans, sewing-machines and other apparatus, places it in a unique position to supply a motor the qualities of which are unquestioned.



DIEHL ELECTRIC COFFEE MILL.

The general appearance of the mill as well as the arrangement of details is shown in the accompanying illustration. The grinder, gear case and back cover are combined in one unit, giving rigidity and compactness. The hopper is of spun brass, provided with a spun-brass cover, and both are heavily plated with nickel highly polished. The motor base is extended to hold the receiver, making the entire combination entirely self-contained. The mill may be readily adjusted to give any desired degree of fineness by means of a thumb-screw regulating the distance between grinders. The motor is provided with a switch for starting and stopping, and has ten feet of flexible cable attached. When the mill is put in service all that is necessary is to connect the plug to a convenient light socket and turn the switch.

The Doubleday-Hill Electric Company.

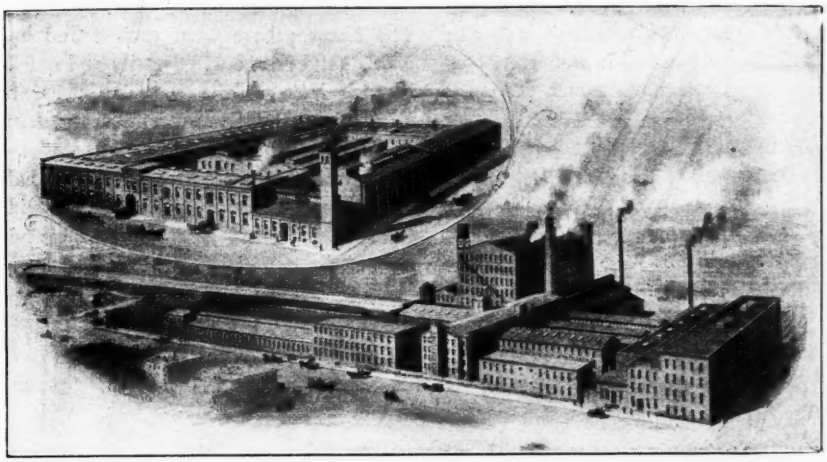
The Doubleday-Hill Electric Company, at 919 Liberty street, Pittsburg, Pa., is one of the largest electrical supply houses in the world. This company began business in one room in the Lewis Block ten years ago. The present business home of the concern is in a handsome building with eight floors, aggregating more than 50,000 square feet of space. In addition to the home office the company has two large auxiliary warehouses for the storage of surplus stock, and maintains a large branch supply house at Charlotte, N. C. The most interesting feature of this company's business is its large repair and winding shop, one of the busiest and most thoroughly equipped in point of labor and machinery to be found in the country. The company makes a specialty of the rewinding and repairing of all makes of both machine and hand-wound armatures. In its repair shop the company also refills, reinsulates and assembles all makes of commutators, and is prepared to furnish all necessary new parts for any of this apparatus, as well as are lamps and, in fact, anything electrical that requires repairing. The company manufactures commutators, field and armature coils, switchboards, trolley wheels, and in the past has made quite a variety of special electrical equipment. In addition to the manufacturing and general distributing features of the business the company is sole agent for the Excello flaming arc lamp, A.-B. arc lamps, and includes among its exclusive specialties "O. K." weatherproof wire and cables, Triumph dynamos and motors, Emerson alternating fans and motors, Adams electric rock drills, Packard transformers, G. E. dynamos and motors.

The company is incorporated under the laws of the state of Pennsylvania with an authorized capital of $300,000. The president is C. Phillips Hill; the vice-president and treasurer, G. B. Hill, and the secretary, H. G. Shaler.

In addition to its comprehensive repair shops, factory and storehouses, the company has developed a business and office system which minimizes delays and facilitates the selection of material, and insures prompt shipping and tracing of all orders. The company maintains a large corps of traveling representatives and handles the largest orders placed in this field.

The Waterbury Company.

The Waterbury Company, with offices at 80 South street, New York city, and factories in Brooklyn, N. Y., is one of the largest manufacturers of seamless rubber-insulated wire and cables; paper-insulated, lead-encased cables; railroad signal wires, lamp cord, and flexible cords, as well as manila and sisal rope, oil-well cordage, wire rope, and music wire. The company was established in 1816, and commenced the manufacture of rubber-covered wire, telephone wires and special cables three years ago. Since the opening of this plant business has steadily increased until the company is now counted as one of the foremost manufacturers of this product.



THE BROOKLYN, N. Y., WIRE AND ROPE MILLS OF THE WATERBURY COMPANY.

The accompanying illustration shows the rubber-covered wire mill and the other mills operated by the company. Branch offices are established in Chicago, Pittsburg, New Orleans and San Francisco.

The Crouse-Hinds Condulets.

The development of condulets by the Crouse-Hinds Company, of Syracuse, N. Y., is being watched with much interest by all who are concerned with wiring propositions. The simple device, in most types, consisting of but two pieces, a cast shell and a cover, has simplified the conduit construction in such a marked degree that it is fast gaining the title of the "Key to Conduit Construction." The fittings are very simple in design, which point, together with the general neat appearance, occasions many conduit installations that would not have been undertaken in time past.

Condulets are made in many styles; in fact, it can be truthfully said there is a style for practically each and every requirement that may occur in any conduit or combination conduit and molding installation.

The illustrations which are shown herewith represent a type "A" and "C" fitting. The castings are provided with one or more threaded hubs, according to the type, into which the conduit is screwed. This form of construction insures continuity of conduit system, an important feature, and at the same time requires no more time to install than that involved in running a nut on a bolt or a nipple on a pipe.

TYPE "A" CROUSE-HINDS CONDULET.

It is not necessary to run the wires until the system is completed, as they can be drawn through the conduit to the condulets whose function is the same as that of a manhole in a large conduit system. The covers are fastened to the castings and wires are drawn through, taps having been made, if branch wires are desired at this point. Blank metal covers are generally used where no branches are taken off. There are numerous styles of covers provided with standard nipples; also some types are provided with adjustable plates, so that fixtures, switches and various fittings can be mounted thereon.

TYPE "C" CROUSE-HINDS CONDULET.

The type and location of condulets in any system are determined by the requirements of the wiring plan.

The Aurora Miniature Arc Lamp.

The Aurora Electric Company, Aurora, Ind., has placed on the market a miniature direct-current arc lamp. This lamp is simple in construction, substantial and neat in design. The resistance coil is mounted within the case, and the inner globe and guard are held in position by compression springs and permit of easy removal without the use of tools. The carbon feed works automatically, preventing burning out of the lower carbon holder. The maintenance costs are low, and an ordinary workman can easily trim the lamp.

The lamp has a consumption of two amperes at 125 volts, one and one-half amperes at 250 volts, and the carbons have a life of thirty hours.

A steady, pure-white light equaling fifty ordinary incandescent lamps is given, the current consumption being the equivalent of four incandescent lamps. The lamp is fifteen and one-half inches long by four and one-half inches in diameter. The weight complete, including porcelain shade, is seven pounds. The case is made of polished brass, or is given an oxidized metal finish. The lamp is especially adaptable for store windows, stores, halls, theatres, factories, etc.

AURORA MINIATURE ARC LAMP.

The Aurora Electric Company is the manufacturer of an electromagnetic socket, which, by means of magnetic attraction to iron or steel, will hold an incandescent lamp in any position, allowing the light to be applied directly where desired. It can be used in any place or position where there is an iron or steel surface. It holds the lamp firmly and can be applied instantaneously.

Galvanized Stamped-Steel Outlet Boxes and Covers.

The Pratt Chuck Company, Frankfort, N. Y., is the manufacturer of a fine line of galvanized stamped-steel outlet boxes and covers. Included in this line is a box for combination gas and electric fixtures, shown in the accompanying illustrations. This box is four inches square and one and

PRATT GALVANIZED SEAMLESS CONDUIT BOX.

five-eighths inches deep. It has eight conduit outlets in the sides and five in the bottom. There are two gas outlets, one in two opposite sides, for one-half-inch gas pipe only. The other side outlets are for one-half-inch or three-quarters-inch conduit only. The boxes are also arranged for gas elbows.

Other boxes which this company manufactures are the BA switch outlet or junction box, the CA outlet and junction box,

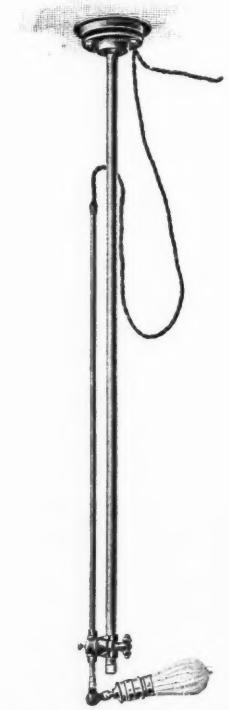
PRATT ROUND CONDUIT BOX COVER.

which is a round box four inches in diameter and one and five-eighths inches deep. The DA deep outlet and junction box for lath and plaster is four inches in diameter and two and one-quarter inches deep. This is equipped for four outlets in the sides and five in the bottom. The side outlets are for one-half-inch, three-quarters-inch and one-inch conduits. The boxes are drilled for fixture stems, and the flat steel cover is drilled for standard ten-ampere rotary snap switch. Other boxes are the EA box for G. E. receptacle No. 50,746 and for Bryant receptacle No. 5,050; the GA box, equipped for Norbitt, Trumbull, "P. & S." and G. E. receptacles. The company furnishes steel or polished-brass covers for Federal sockets and rotary snap switches in connection with its FA and CA boxes.

The HA, IA and KA boxes for ceiling outlets in terra-cotta are four inches or five and one-half inches in diameter, one-half inch or three-quarters inch deep.

Adjustable Fixtures for Incandescent Lamps.

The O. C. White Company, Worcester, Mass., is the manufacturer of a very extensive line of standard adjustable fixtures for incandescent lamps for shops, mills and factories, drafting rooms, offices and banks, for residences, libraries and dressing rooms. These are made in plain



WHITE ADJUSTABLE LIGHTING FIXTURE.

forms and in combination with gas fixtures. These fixtures are strongly constructed and designed to withstand hard usage. They are constructed of iron and gun metal, and are listed in a variety of finishes to harmonize with the hardware and fittings generally used. The plain black finish is best adapted for shop fixtures. The plated finishes are frequently used where fixtures of rugged construction are required for offices, libraries, banks and well-appointed drafting rooms. The fixtures have been revised and approved, and can be wired easily and quickly with New Code wire. The arms are all straight and true and slide and turn freely to any adjustment.

The ceiling fixtures are fitted with ball and socket base joint, swiveling and sliding cone joint and wrist joint. This adjustability permits of turning the lamp

WHITE STRAP-CLAMP DESK LIGHTING FIXTURE.

instantly into any desired position, and gives perfect protection to the cords and lamps among moving and shifting belts in shops and factories.

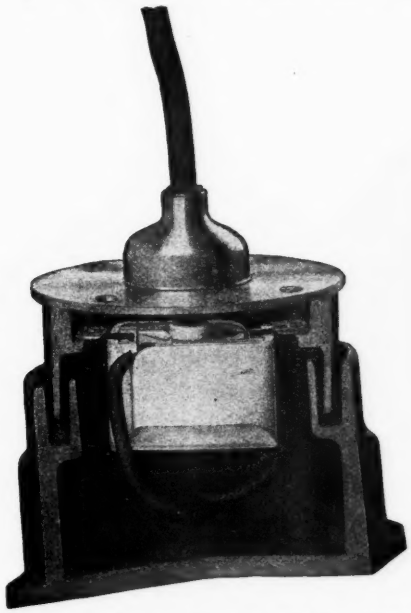
One of the latest designs is the strap-clamp desk fixture. This is made for direct attachment to a roll-top desk. The main joint embodies entirely new mechan-

WHITE ADJUSTABLE LIGHTING FIXTURE.

ical principles and permits turning, tipping and sliding adjustments to any position or angle by frictional tension secured at one point or fastening. The standard wrist joint at the end of the lamp gives free angular adjustment to the lamp.

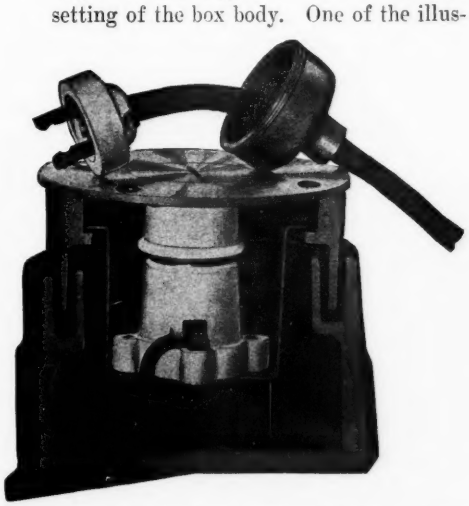
Fullman Water-Tight Outlets.

One of the popular specialties manufactured by the Steel City Electric Company, of Pittsburg, Pa., is the Fullman water-tight floor outlets. The accompanying illustrations will indicate better than

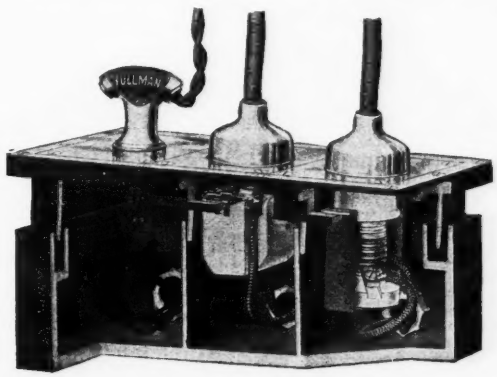


SECTIONAL VIEW OF FULLMAN FLOOR OUTLET, WITH BELL NOZZLE.

a lengthy description the adaptability and utility of these devices. The apparatus is moisture-proof, and the universal tilting adjustment water-tight feature is peculiar to the Fullman designs. The floor plate is always flush and even with the floor, and alignment of receptacles is always correct, regardless of the crooked setting of the box body. One of the illustrations herewith shows a sectional view of the four-and-three-quarters-inch box with a bell nozzle and standard flush plug receptacle. Another illustration shows the same box with a Hubbell plug and a two-inch flush brass plug closing the opening in the floor plate. Still another illustration shows a sectional view of a rectangular gang box of three sections, showing a "drip" nozzle in use, a bell nozzle in use, and a two-inch flush brass plug closing one opening. These gang boxes are furnished in two, three, four, five and six sections. The minimum height to the top of the cover is four and one-quarter inches.



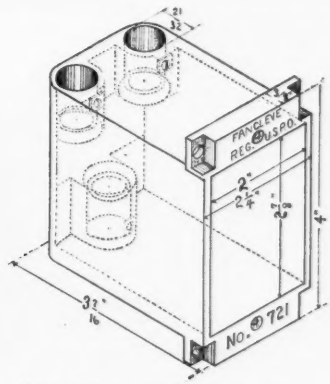
FULLMAN BOX WITH HUBBELL ATTACHMENT.



SECTIONAL VIEW OF FULLMAN RECTANGULAR GANG BOX.

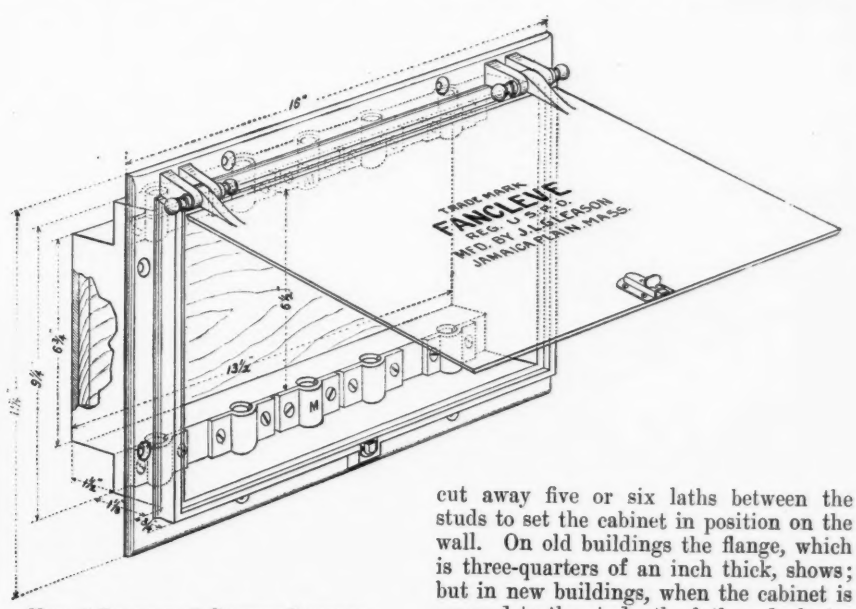
Some New "Fancleve" Specialties.

John L. Gleason, of Jamaica Plain, Mass., patentee and manufacturer of "Fancleve" specialties, has recently placed on the market two new fittings for use with Greenfield BX armored cables in old buildings. One of these fittings is a switch box which is made in sizes from one to four gangs and will fit any standard switch or receptacle. The cable pockets have a shoulder at the inside end to check the armor of the cable, and the surfaces through which the conductors project are rounded to prevent abrasion or chafing of the braid. A suitable plug is supplied in every pocket but one in each box, so as to seal it if the pocket is not used.



NEW "FANCLEVE" SWITCH BOX.

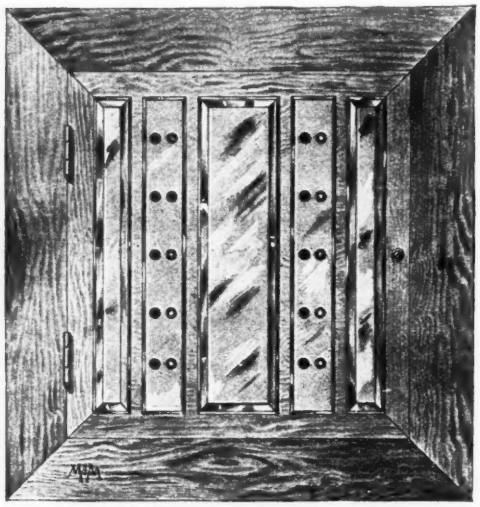
The other fitting is a cutout cabinet with a capacity of eight circuits. Four circuits enter at the top and four at the bottom. There are two entrances for the mains, opposite each other, and designated by the letter "M." The pockets are reamed to confine No. 8 or No. 10 cable, and the branches are reamed to take No. 12 or No. 14 cable. It is intended that the cables be brought up or down partitions between the studs, and the cabinet is of such a size that it is only necessary to cut away five or six laths between the studs to set the cabinet in position on the wall. On old buildings the flange, which is three-quarters of an inch thick, shows; but in new buildings, when the cabinet is screwed to the studs, the lath and plaster come out flush with the edge of the cabinet. The fitting is of iron, excepting a beading of half-inch hardwood to which the cutouts are fastened. The door raises upward, so that it tends to stay closed through the action of gravity. The fitting weighs about twenty-four pounds.



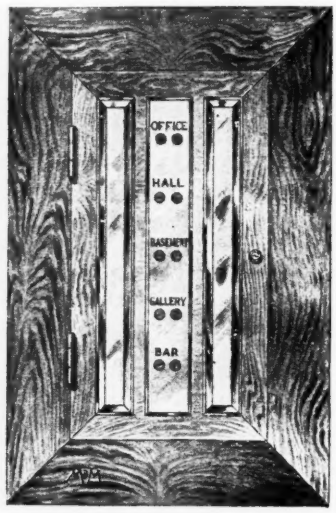
NEW "FANCLEVE" CUTOUT CABINET.

"M. & M." Panel-Boards.

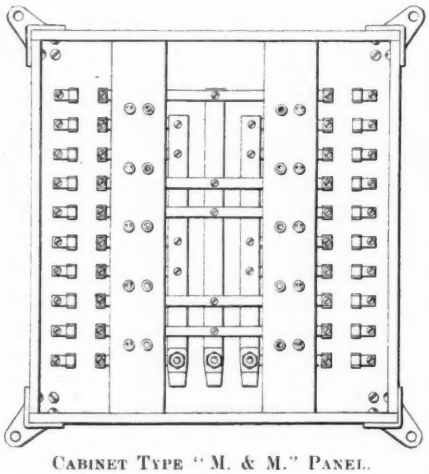
The Machen & Mayer Electrical Manufacturing Company, Twelfth and Buttonwood streets, Philadelphia, Pa., has placed on the market a new type of panel-board known as the "M. & M." panel-boards of the push-button switch type. These panel-boards are very handsome in appearance, and are adapted to the highest class of installations. They are made in several different types. The cabinet type is adapted to use in any ordinary panel cabinet of the proper size. This type is divided into two classes, one operated by push-button switches and the other operated by lock switches. The flush type of panel-board is furnished with door and trim. The difference between this type and the cabinet type is in the door and trim, the door having openings in it, allowing the switch face-plate to extend through, so that the switches can be operated from the outside without opening the door. This type of panel is also divided into two types, one using push-button switches, and the other lock switches.



FLUSH TYPE OF "M. & M." PANEL WITH PUSH-BUTTON SWITCHES.



FLUSH TYPE OF "M. & M." PANEL WITH LOCK SWITCHES.



CABINET TYPE "M. & M." PANEL.

There is no danger of the operator coming in contact with any live parts. The brass face-plate over the switches serves as a convenient directory of the various circuits.

To replace a defective switch it is not necessary to disturb the panel-board or other switches, as any switch can be replaced from the front of the panel.

Where panel-boards are located in hallways, in public buildings, or in places where it is desirable to have the lighting circuits under the control of either the superintendent of the building or some special attendant, the lock-switch type of panel-board offers the advantage that the lights can not be turned on or off except by the attendant with a key specially designed to operate the switches.

The flush type of panel is two and one-half inches deep, while the cabinet type is three and one-half inches deep. Either of these types of panel can be made with meter loops and with four bus-bars for use on two-phase circuits; also with knife switches in the mains if desired. The Underwriters' specifications are followed in every respect in the construction of these panel-boards, and the "M. & M." shallowest flush push-button switches used in their construction have been tested and approved by the Underwriters.

The Prometheus Electric Plate-Warmer.

The electric plate-warmer is not, strictly speaking, a new device. Plate-warmers have been made for several years, and hundreds of them are in use, particularly in the large cities. Contractors outside of New York city, however, are probably not sufficiently alive to the possibilities for profitable orders represented in this branch of the business. The arguments in favor of electric heating are too well known, and have been repeated often enough, to be omitted. It will suffice to say that the electric plate-warmer is eminently convenient, no matter where used, and is a necessity wherever meals are served and electric current is available.

The accompanying illustration shows an electric plate-warmer made by the Prometheus Electric Company, 236-238 East Forty-third street, New York city. These plate-warmers are heated by means of individual electric resistances attached to the sides on the inside of the plate-warmer, and covered with flues which project but one inch into the interior of the apparatus. The electric equipment, therefore, takes hardly any room and economizes greatly in space over those plate-warmers which use gas or steam pipes for producing the heating element. This apparatus has been pronounced a very practical equipment. The arrangement of the resistance units insures a continuous circulation of heated air, and the entire inner space is heated to a uniformly high temperature.

THE PROMETHEUS ELECTRIC PLATE WARMER.

These plate-warmers, as a rule, are made to architects' specifications, and for this reason are built to order only. Russia iron is used in the construction, and the double walls are mounted on an angle-iron frame. The intervening space is lagged with mineral wool or asbestos.

Bishop Gutta-Percha Company.

During the past year the factory of the Bishop Gutta-Percha Company, 420-430 East Twenty-fifth street, New York city, has been entirely remodeled and considerably enlarged. A new building, five stories in height and covering a plot fifty by 100 feet, has been erected adjacent to the old factory building. Special attention has been given to lighting and ventilating, it having windows on all sides. Pains have been taken in the matter of fire protection, the first two stories and basement being of up-to-date fireproof construction and the building equipped with automatic-sprinkler system, having both gravity and pressure tanks.

The power plant for the entire factory is located in the basement of the new building and all machines are now driven electrically, using a two-phase alternating current with a potential of 220 volts.

The buildings are well lighted with Nernst lamps, so that in case of necessity work can be done at night as well as day. New insulating and braiding machines of the latest type, as well as a modern lead press, have been installed. With new machinery and increased floor space, the facilities for manufacturing both rubber-covered wire and gutta-percha goods have been increased from sixty to seventy-five per cent.

The business of this company was established for the manufacture of gutta-percha goods in 1847, which has been carried on continuously ever since.

The plant for rubber-covered wire was installed early in the eighties, and the company has ever since made a specialty of high-grade insulated wires and cables, furnishing a considerable number of submarine cables for telegraph, telephone and power service, as well as gutta-percha insulated cables for submarine use.

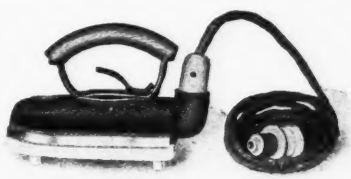
The Bishop standard high-grade wire, elevator control or traveling cables, annunciator and lighting cables and the asbestos-covered car cables of this company's make are well known throughout the country.

In the new building is installed an up-to-date testing laboratory with electrical testing set for high voltages and insulation resistance. The company is continuing to manufacture, as it has since 1847, all kinds of gutta-percha goods.

The president of the company, Henry A. Reed, who entered the telegraph field in 1849, has been nearly thirty years engaged in the Bishop factory, during which time he has been considered a leading authority on electrical insulation, is still active in the business, having associated with him in its management two of his sons, Henry D. Reed, M.E., Stevens, 1892, who has been engaged in the business for the past fifteen years, and W. Boardman Reed, C.E., Union, 1882, treasurer of the company, who was for many years connected with electrical railway work.

Economy Electric Heating Apparatus.

The Economy Electric Company, 217 Fulton street, Brooklyn, N. Y., is placing on the market a number of useful electrical heating and cooking devices, including soldering and branding irons, flat-irons and other heating specialties. The Economy electric soldering and branding irons are made for all standard voltages.



Economy Electric Flat-Iron.

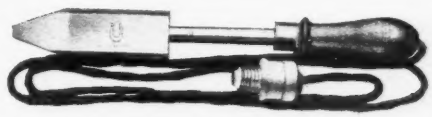
Component Parts of Economy Electric Flat-Iron.

The irons are constructed to meet the necessary requirements of the Board of Fire Underwriters, being made of the best approved material. The principle and construction of these irons are such that all the heat is concentrated in the copper, preventing the wasting of electrical energy due to the heating of shells and casings.

One of the illustrations herewith shows an electric soldering iron for medium work. This size and style is best adapted for work in shops, buildings, garages, yachts, and is serviceable for soldering connections and for making up string lights for stage lighting. This iron consumes 150 watts.

The branding iron shown herewith consumes 350 watts and is designed to meet all the necessary requirements for branding provisions in packing houses under the new inspection laws. Other forms of iron are made for soldering telephone and telegraph connections and for work in obscure places. This form of iron consumes seventy-five watts. Another iron consuming sixty watts, and still another consuming 100 watts, are made for light work. Other irons consuming 200 watts and 300 watts, and a heavy iron consuming 400 watts, are also available.

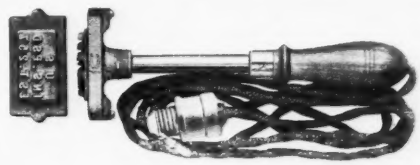
The Economy electric flat-iron, shown herewith, is equipped with a flat mica disc wound with a heating element of exceptionally long life. The company guarantees that its goods, in addition to having a long life, are very economical in the consumption of current. The internal



Economy Electric Soldering Iron for Medium Work.

electric heater covers the entire bottom of the iron, thus heating the entire surface of the iron.

The iron is equipped with a removable handle. This is an important feature, as no current is consumed in heating the handle and no protecting pad is needed.



Economy Electric Branding Iron.

The handle is always cold because it can be removed when the iron is not being used.

Weber Fuse Plugs.

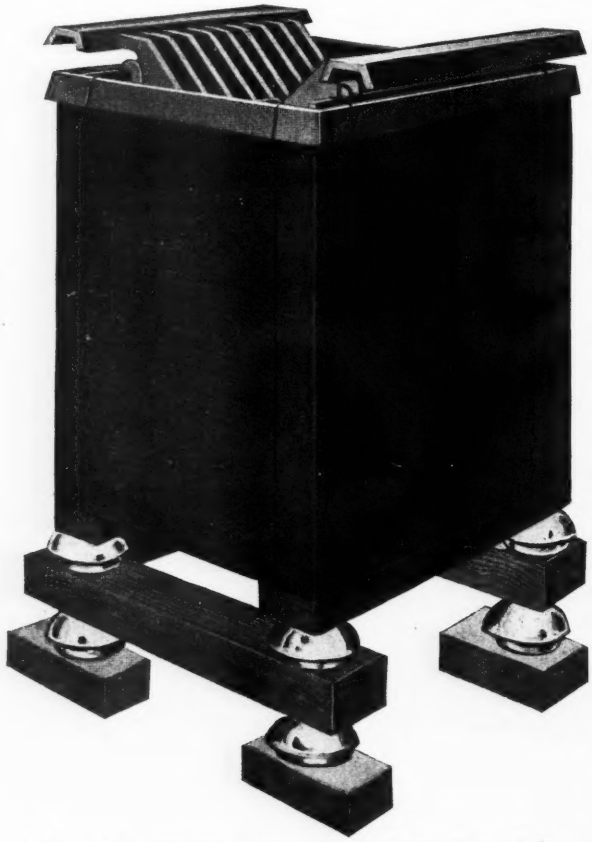
Henry D. Sears, 131 State street, Boston, Mass., general sales agent for Weber electric wiring specialties, announces the new Weber fuse plugs for 125 volts, with mica caps, illustrations of which are

New Weber Fuse Plugs.

shown herewith. When the fuse blows there is no possibility of the escape of molten fuse metal; the large vent holes provide for the proper escape of gas, and there is no outside lump of solder to prevent proper bottoming of the plug in the cutout. These plugs are made in capacities from three amperes to thirty amperes.

The Electric Storage Battery Company.

The Electric Storage Battery Company, Philadelphia, Pa., is the manufacturer of three general forms of storage batteries bearing the trade-marks respectively of the "Chloride Accumulator," the "Tudor Accumulator" and the "Exide Accumulator."



TYPE "G" NINETEEN PLATES IN LEAD-LINED WOOD TANK.

TYPE "B" THREE PLATES IN GLASS JAR.

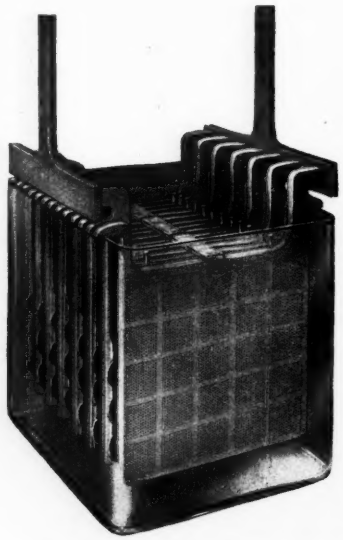
This product represents the highest development of this branch of the electrical industry. Installations of these batteries are not only found in general use throughout the United States but also in South America, Mexico and Canada.

The smaller cells of the "Chloride Accumulator," embracing the two-plate types and types B, C and D, are used where a small current capacity is required, thousands of these cells being operated for police and fire-alarm systems, telegraph, railway signals, laboratory service and for small isolated lighting plants.

The larger cells, embracing types E, F, G, R and H, are employed for lighting and power stations, street and interurban railway service, electrification of steam railroads, residential and isolated lighting, etc.

The "Tudor Accumulator" and the "Chloride Accumulator" are used in the special forms, designed by the company, for the electric lighting of railway cars. A complete description of these types is contained in a catalogue recently issued under the title of "Car Lighting Cells," Catalogue C.

The "Exide" battery is used principally for electric-vehicle propulsion and for the ignition of gas or gasolene engines in automobiles, power boats, stationary service, etc.

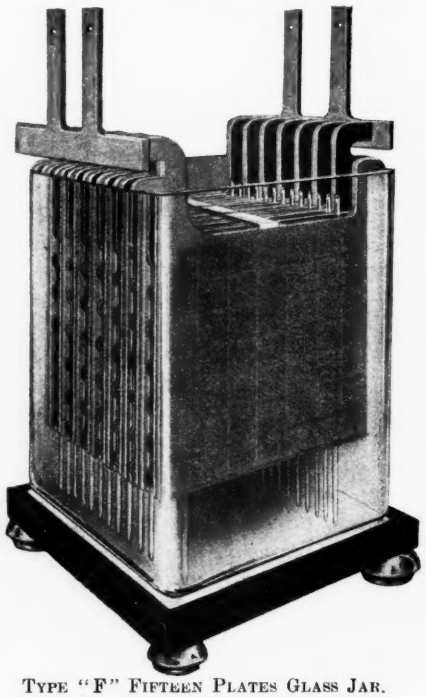


TYPE "E" THIRTEEN PLATES IN GLASS JAR.

The extensive use of the "Exide" battery necessitated the opening of "Exide battery depots" in different cities, and about 400 "Exide distributors" throughout the country are prepared to supply and maintain "Exide" batteries and parts.

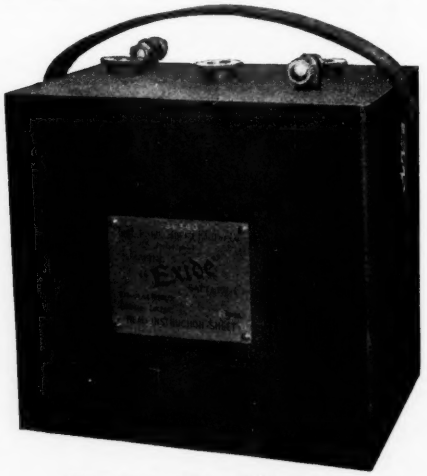
It has always been the policy of this company not only to produce the best batteries, but to devise instruments and furnish the required instructions for maintaining their cells in the best possible condition. To this end a force of operating engineers is employed in constantly superintending the working of batteries installed by this company, thus insuring their economical operation and efficiency.

The auxiliary apparatus and accessories for use with storage batteries designed and constructed by this company are the result of twenty years' experience and the labors of an engineering force specially trained in battery work.



TYPE "F" FIFTEEN PLATES GLASS JAR.

The company does a large business through electrical contractors in the installation of batteries in residential, mill, factory and similar isolated plants, and has issued bulletins especially covering these applications.



PORTABLE "EXIDE" BATTERY.

The LeValley Vitae Carbon Brush with Pigtail Connection.

The accompanying illustration shows the new form of carbon brush which has been placed on the market by the LeValley Vitae Carbon Brush Company, 405 East Tremont avenue, New York city. The advantageous feature of this new connection is that it is indestructible. The copper plates to which the lead is attached are firmly clamped to the carbon on each side by expanded copper rivets, making a perfect contact. Solder does not enter in any way into its construction, and it can

LeValley Vitae Carbon Brush with Improved Pigtail Connection

not therefore melt off or become detached from the carbon. The brush maintains its even proportion throughout, fitting snugly in the brush-holder until the brush is worn out. This insures a perfect contact, and the brush can not tilt over. This invention is owned by M. W. Robertson, sales manager of the company.

Westinghouse Small Power Motors.

The small power motors supplied by the Westinghouse Electric and Manufacturing Company for either direct current or single-phase alternating current, are particularly compact and durable under all sorts of operating conditions. They are all automatic in their starting char-

Westinghouse Small Power Motors.

acteristics, as in starting it is only necessary to close the main switch. The motors will in all cases start full load and will stand considerable overloads.

The motors are manufactured regularly in sizes from one-twentieth to one-quarter horse-power, for either 110 or 220 volts in standard speeds. The illustrations show both the direct and alternating-current motors in the one-sixth-horse-power size. The motors are given a horse-power rating on an intermittent basis of full load for one-half of the time, with no period at full load longer than one-half hour. These motors are regularly manufactured for sixty and twenty-five cycles, although in some cases they are supplied for 133 cycles.

Annual Summer Conference of the Fostoria Incandescent Lamp Company.

The annual summer conference of the salesmen of the Fostoria Incandescent Lamp Company, Fostoria, Ohio, was held during the week of June 22 at Ballast Island, in Lake Erie, near Put-in-Bay. It was attended by about twenty-five representatives from all parts of the United States, and an extensive programme of technical sessions and entertainment features was carried through. The meeting was pronounced a marked success, and it was especially important on account of the fact that this has been the first meeting held since all of the high-efficiency incandescent units have been commercially perfected.

Annual Summer Conference of the Fostoria Incandescent Lamp Company's Salesmen, Ballast Island, Lake Erie.

The company's factory at Fostoria is now undergoing extensive alterations and enlargement. In addition to this, the construction is being strengthened throughout on account of the manufacture of tungsten lamps. Heavier material, including heavy maple flooring, etc., is being installed, and when this work is finished the factory will not only be practically as good as new, but have a considerably larger production and a correspondingly better equipment.

Meeting of the New York State Electrical Contractors.

The semiannual meeting of the Electrical Contractors' Association of New York State was held at Buffalo, N. Y., on June 22, 23 and 24. The programme included a meeting of the board of directors on June 22, a meeting of the general association, luncheon and banquet on June 23, and a private trip to Niagara Falls and inspection of the plants of the Niagara Falls Power Company, Hydraulic Power and Manufacturing Company, Canadian Niagara Falls Power Company, Ontario Power Company, Electrical Development Company of Ontario, with dinner at the Clifton Hotel, Niagara Falls, Ontario, on June 24.

For this semiannual meeting each of the various local contractors' associations send delegates or representatives. About thirty of these representatives were present. The total attendance was 110, and eighty members were present at the banquet.

The present officers of the association are: James Hilton, president, Syracuse, N. Y.; Edmond D. McCarthy, vice-president, Buffalo, N. Y.; George W. Russell, Jr., secretary, New York city; James F. Burns, treasurer, Schenectady, N. Y.

Civil Service Examinations for New York State and County Service.

The New York State Civil Service Commission will hold examinations on July 25 for the following positions: Assistant in economic geology, State Museum, $1,200; engineering examiner, Civil Service Commission, $1,000 to $1,200; leveler, $4.50 to $5 a day; structural engineer, state architect's office, $2,000.

The last day for filing applications for these positions is July 18. Full information and application forms may be obtained from Charles S. Fowler, chief examiner, Albany, N. Y.

The Society for the Promotion of Engineering Education.

The sixteenth annual meeting of the Society for the Promotion of Engineering Education was held at Detroit, Mich., June 24, 25 and 27. The address of welcome was delivered by Mayor Thompson. In the absence of President Howe the chair was occupied by Vice-President W. G. Raymond, of the University of Iowa.

Professor Dugald C. Jackson presented the report of the joint committee on engineering education. This committee is formed of representatives of the national engineering societies.

A paper was read by Professor J. Martin Telleen, of the Case School of Applied Science, on "The Course in English in Technical Schools." Another paper of the same nature was presented by Dr. William Kent, entitled "Results of an Experiment in Teaching Freshman English." Howard Frost presented a paper entitled "A Proposed Course in General Engineering." Professor W. T. Magruder presented a paper entitled "Present Curricula of the Mechanical Engineering Courses."

On Wednesday evening there was a joint session with the American Society of Mechanical Engineers, when a lecture was delivered by Professor Brashear on "Contributions of Photography to our Knowledge of Stellar Evolution."

The second session of the society was held on Thursday afternoon. The annual address of President Charles S. Howe was entitled "The Function of the Engineer in the Conservation of Natural Resources of the Country." A. L. Rice read a paper on adapting means to the end in technical education. A paper taking up the question of the place of foreign languages in the curriculum in schools of engineering was presented by Professor A. L. Wright. Professor W. F. M. Goss read a paper on second degrees for graduates of engineering courses. The subject of scholasticisms in engineering education was presented by John Price Jackson.

The Saturday morning session was devoted to a discussion of papers by Dr. Schneider, of the University of Cincinnati, and Professor Furman, of Stevens Institute of Technology.

Monument to John A. Roebling.

The entire city of Trenton, N. J., joined in paying tribute to the memory of John A. Roebling, founder of the John A. Roebling's Sons Company, Trenton's greatest industrial corporation, upon the occasion of the unveiling of a monument to Mr. Roebling at Cadwalader Park, on Tuesday, June 30. This magnificent tribute was the occasion of the dedication of the monument erected by the Roebling Memorial Association. During the afternoon practically all mercantile business in the city was at a standstill because of the gathering of thousands of people to witness the ceremonies. Preceding the formal dedicatory programme at Cadwalader Park there was a parade of 5,000 employés from the Trenton plant of the John A. Roebling's Sons Company and 1,000 from Roebling, N. J., the industrial town on the Delaware River which has been built up to carry on the overflow of the Roebling industry from the Trenton mills.

Colonel Mahlon R. Margerum was master of ceremonies. The first number of the set programme was the American overture by Winkler's Second Regiment Band. Prayer was offered by the Rev. Dr. W. Strother Jones, rector of St. Michael's Episcopal Church. The United Singing Societies of Trenton, under the direction of Dr. Carl Hoffman, sang "Der Tag Des Herrn." Miss Emily M. Roebling, daughter of Charles G. Roebling, and granddaughter of John A. Roebling, pulled the silken cord which released the United States flags which covered the bronze statue, created by William Couper, of New York. The band then played the bridal chorus from "Lohengrin." Colonel Margerum introduced former Governor Edward Casper Stokes, who, after a brief eulogistic address, introduced Henry D. Estabrook, general counsel of the Western Union Telegraph Company and father of Mrs. Karl G. Roebling, who delivered the oration.

At the close of Mr. Estabrook's address the United Singing Societies sang "The Star-Spangled Banner," which was followed by an address by former state Senator Jonathan H. Blackwell, who introduced the sculptor, William Couper, of New York. The set programme was closed with the rendition of the coronation march from "The Prophet."

During the ceremonies a cablegram from the mayor of Muhlhausen, Germany, the birthplace of Mr. Roebling, was read. A brass wreath sent by the citizens of Muhlhausen was placed on the monument.

The monument is fifteen feet seven inches high, exclusive of the four and one-half feet of concrete base, which is entirely underground. The stonework supporting the statue is nine feet high, and the statue measures six feet seven inches. The figure is modeled in a sitting position. The statue is made of bronze, and was cast in the plant of the Gorham Manufacturing Company, Providence, R. I. The cast was made from a clay model designed by Mr. Couper at his studio in New York city. The pedestal is built entirely of Bonacord red Swedish granite, which was quarried in Sweden and polished in Aberdeen, Scotland. On the right side of the granite pedestal is a bronze panel bearing a reproduction in relief of the first railroad suspension bridge ever built, over the Niagara. On the left side is another panel containing a replica in relief of the Brooklyn Bridge. The front of the pedestal is occupied by the following inscription:

John A. Roebling, Civil Engineer,
Designer and Builder of Many Suspension Bridges,
Founder of Trenton's Greatest Industry,
An Energetic Worker, Inventor and Man of Affairs,
Devoted to His Adopted Country,
In Whose Progress He Had Unswerving Faith;
A Patron of Art and Sciences,
A Benefactor of Mankind.
This Monument Is Erected by the Citizens of Trenton and His Sons in the Year 1907.

The monument in its entirety represents a cost of $14,000, of which $10,000 was expended for the statue. The greater part of this money was obtained by popular subscription, and the remainder was contributed by the sons of the distinguished bridge builder. The committee in charge of the subscription movement follows: Harry S. Maddock, president; Louis Fisher, secretary; Philip Freudenmacher, treasurer; Christian Guenther, Jonathan H. Blackwell, Samuel Walker, John C. Schweizer, General C. Edward Murray and Mahlon R. Margerum.

In connection with the dedicatory ceremonies, former Mayor Daniel J. Bechtel presented handsome souvenir medals of the Roebling monument dedication to Charles G. Roebling, Ferdinand W. Roebling and Colonel Washington A. Roebling. They are made of copper and porcelain, symbolic of two of Trenton's greatest industries.

International Congress of Inventors.

TO THE EDITOR OF THE ELECTRICAL REVIEW:

A discussion having arisen in various parts of the country regarding the status of the inventor with relation to the United States Patent Office and expressive of the opinion that inventors of the country should form a national organization for the protection and advancement of their interests, permit us to state that just such an organization exists in the International Congress of Inventors, established in 1906, incorporated in 1907, and having members in several states of the Union, with branches formed or forming in Texas, Missouri, Illinois and California.

This organization was established to benefit inventors as a class by seeking to secure legislation which shall insure to the inventor the services at the Patent Office which his application fees should provide, and the protection for his invention which a government guaranty should give.

Largely through the efforts of the International Congress of Inventors the Federal congress has this year provided for an increased force of examiners in the Patent Office and for an advance in the salaries of Patent Office employés which will tend to retain in government employ those who have become expert in the treatment of applications. A patent fund of $7,000,000 has been accumulated from the sums paid to the government by inventors, and the Patent Office is the only self-sustaining Federal department. Surely the inventors of the country are entitled to the consideration which these facts warrant.

An important matter under consideration by the International Congress of Inventors is the establishment of a standard for a United States patent. The patent system purports to be a method of rewarding inventors and thereby stimulating the production of inventions of value to the public. But patentees and holders of patents find that a United States patent in order to attain a definite standing must be tried out in court. Yet a guaranty of protection issued by the government ought to be something more than a license for a law suit. The International Congress of Inventors is giving this matter careful consideration and it will seek such action by the government as will make a patent conform to its purport. This is one of the many subjects now before this organization. Suggestions in the interest of inventors and all who hold patents are solicited by this organization.

RALPH T. OLCOTT,
Secretary.

Rochester, N. Y., July 2.

Relation of Government Fuel Investigation to the Solution of the Smoke Problem.

At the annual convention of Smoke Inspectors, held at Cleveland, Ohio, June 24, an address entitled "The Relation of the Government Fuel Investigation to the Solution of the Smoke Problem" was delivered by D. T. Randall, engineer in charge of tests, United States Geological Survey, Fuel Testing Plant. Mr. Randall indicated the great economic waste in the present methods of handling coal as a fuel, and pointed out the savings which were being developed due to the proper utilization of the waste gases in producer plants. He described the work of the Geological Survey, which was begun at St. Louis during the exposition in 1904, and which has since been continued at St. Louis and at Norfolk, Va.

The possible benefits to the government and to the public resulting from such experiments led President Roosevelt to appoint a number of prominent engineers, some in the employ of the government and some members of the great national engineering societies, to act as an advisory board on fuel and structural materials investigations.

A study of the fuel values of coals burned while conducting some 540 boiler tests has shown that the value of the coal depends almost entirely on the number of heat units which it contains. For the coming year a large part of the coal purchased for the government will be paid for according to its heat value as determined in the government chemical laboratories. One of the largest purchases under this form of contract is for use on the Isthmus of Panama, and calls for the delivery of 400,000 tons within the year.

Investigations along other lines have indicated the possibilities of utilizing poorer grades of coal than are now commonly used. Experiments on the briquetting of coal have shown that the slack coal, which is otherwise difficult to utilize, may be made into artificial lumps and used with high efficiency.

Tests upon various furnaces have shown the influence of different methods of burning coal with relation to the reduction of smoke. These tests have pointed to possibilities of modifying furnaces so that practically all fuels may be burned without smoke under favorable conditions.

The fuel-testing department is now at work upon bulletins which deal directly with the smoke problem.

Association of Iron and Steel Electrical Engineers.

The first annual convention of the Association of Iron and Steel Electrical Engineers was held at Philadelphia, Pa., in the rooms of the Engineers' Club, on June 24, 25 and 26. The association has a membership of thirty-three, notwithstanding the fact that only the electrical engineer or the electrical superintendent of the larger iron and steel-producing plants is eligible. Addresses were made by the president, James Farrington, of the La Belle Iron Works, Steubenville, Ohio, and by the secretary, G. H. Winslow, of the National Tube Company, Pittsburg, Pa. During the meeting there were several very interesting discussions on the topics of standardization of mill motors, the Stoeckel induction clutch and drive, electric drilling and reaming, electric motors for heavy torque and rapid reversal, and electric motor drives.

On Thursday, June 25, representatives of manufacturers presented brief discussions concerning apparatus used in connection with mill work. H. D. James, of the Westinghouse Electric and Manufacturing Company, spoke on "Control of Motor-Operated Auxiliary Apparatus for Steel Mills." B. Wiley, of the same company, spoke on "Electrical Equipment of Rolling Mills."

The convention was the guest of the Westinghouse company on Thursday evennig at Willow Grove. C. T. Henderson, of the Cutler-Hammer Manufacturing Company, spoke on "New Resistance Grid Interlocking Systems," describing the controlling apparatus installed by this company at Gary, Ind.

On Thursday afternoon the association was entertained at luncheon by Gano S. Dunn, vice-president and chief engineer of the Crocker-Wheeler Company. Later in the afternoon H. F. Stratton, of the Electric Controller and Supply Company, Cleveland, Ohio, described the combination manual and magnetic switch controllers of that company. R. C. Hull, of the Electric Storage Battery Company, spoke on "The Storage Battery in Steel Mills," and on "Storage Battery Regulation of Alternating-Current Circuits." David B. Rushmore, J. G. Callahan, James M. Andrews and K. A. Hawley represented the General Electric Company, and described a number of devices which have recently been brought out by that company.

Trouble for the Mexico City Tramways Company.

The minority stockholders of the Mexico City Tramways Company, Limited, have begun proceedings in the High Court of Justice of England, in London, for an accounting and for the appointment of a receiver for the company. The suit involves property valued at about $10,000,000 in gold.

Current Electrical News

DOMESTIC AND EXPORT.

A $700,000 POWER PLANT PLANNED FOR NEVADA—A movement is on foot to establish at Chalk Mountain, between Wonder and Fairview, Nev., a large power station for the distribution of electricity throughout the mining district. The originators of the plan are P. H. McLaughlin, of Fairview, and Roy Ridge, of Reno, Nev. The electricity will be transmitted a distance of 140 miles to the Chalk Mountain station. The complete plant will cost about $700,000.

PROPOSED SOUTH DAKOTA ELECTRIC ROAD—Articles of incorporation have been filed with the secretary of state for the Aberdeen & Huron Railway Company, with headquarters at Huron, S. D., and a capital of $2,500,000. The company proposes to construct an electric line from Huron to Aberdeen, a distance of eighty miles, to cross the counties of Beadle, Spink and Brown. The incorporators are all Huron men: John A. Cleaver, R. W. Clarke, L. Lapier, J. P. Stahl, G. W. Longstaff, Oscar A. Ricker, R. D. Whorton, R. C. Gibbs and H. J. Rice.

TO BUILD ELECTRIC LINE—The Mesa Valley & El Paso Railway Company, with a capital stock of $1,000,000, has been organized in El Paso, Tex., for the purpose of constructing an electric line between El Paso and Las Cruces, N. M. The incorporators of the concern are El Paso and Las Cruces business men, thirty in all. Each of the thirty has signed for $500 worth of stock in the new company. Papers of incorporation are being drawn up, and it is expected to begin work on the line within thirty days and complete the line within one year. The line will be forty-four miles in length and will traverse some of the richest country in the Rio Grande Valley.

PHILADELPHIA RAPID TRANSIT LOAN—Both branches of the Philadelphia (Pa.) City Councils have approved the plan of the Philadelphia Rapid Transit Company to negotiate a loan of $5,000,000 for extensions and improvements. The conditions of the ordinance provide for the borrowing of $5,000,000, with leaseholds and franchises to be used as pledges. Not more than one-half the total sum is to be raised at the present time, the balance to be secured as needed. New trackage, additional equipment and repairs are the principal uses to be made of the loan money. A number of pay-as-you-enter cars are now being built by the company, and if their use proves successful a part of the money may be used for the purchase of additional cars of this type.

NEW OREGON ELECTRIC RAILWAY ORGANIZED—Articles of incorporation of the Astoria, Seaside & Tillamook Railway Company have been filed in the county clerk's office at Astoria, Ore., by F. L. Evans, E. Z. Ferguson, H. G. Van Dusen and W. E. Buffum, as incorporators. The capital stock is $2,000,000, divided into 200,000 shares of $10 each. The principal office of the company is to be in Astoria, and, according to the articles, its object is to construct and operate an electric railroad and telegraph and telephone lines from Astoria to Tillamook via Warrenton, Hammond and Seaside. It is also authorized to erect and maintain elevators, docks and warehouses and to operate steamers on the Columbia and Willamette rivers, Tillamook Bay and the Pacific Ocean.

MONTANA POWER DEAL—James J. Hill and associates have sold the property of the Great Falls (Mont.) Water Power and Town Site Company to John D. Ryan and others for $1,500,000. John D. Ryan, managing director of the Amalgamated Copper Company, and John G. Marony, president of the Daly Bank and Trust Company of Butte, and of the First National Bank of Great Falls, are the heaviest stockholders. The purchasers deny that the Amalgamated Copper Company has any interest in the deal. The property embraces all of the holdings of the Great Falls Water Power and Town Site Company, a large water-power plant at Black Eagle dam, and the entire generating power of the Missouri River for a distance of twelve miles from the city of Great Falls, east of the "Big" Falls. It is probable that a large electric generating plant will be constructed at the "Big" Falls.

ELECTRIC LIGHTING.

RICHMOND, VA.—The council of Richmond has voted to direct the finance committee to issue bonds not to exceed $350,000 for the purpose of erecting an electric light plant and for improving the city's water system.

PEKIN, ILL.—G. C. Barrett, Milton Seibert and H. G. Herget, managers of the Havana Electric Company, of Pekin, have completed arrangements for the rebuilding of the local plant and the installation of more powerful machinery.

PLYMOUTH, IND.—On Monday, August 10, the city council of Plymouth will receive bids for street lighting for a term of years beginning on the first of February, 1910, according to the proposition on file in the office of the city clerk.

MITCHELL, S. D.—The Mitchell Power Company has bought a block of ground a short distance southeast of the city, upon which it will erect a new electric power-house and a gas plant at a cost of $50,000. Mitchell men are behind the enterprise.

LOGANSPORT, IND.—The board of public works has contracted with Professor Walter Esterline, of Purdue University, to supervise the purchase and putting in of the machinery for the electric light plant, for which the City Council has appropriated $30,000.

OKEMAH, OKLA.—At a mass meeting Okemah citizens approved the plan of voting bonds for the improvement of streets and the installation of a water and electric light plant. For the first proposition $7,000 will be required, and for the latter $8,000.

FORT SCOTT, KAN.—Superintendent F. D. Martin, of the Fort Scott Gas and Electric Company, states that his company is preparing to spend the sum of $50,000 to improve its plant and equipment at this point. It is expected that the work will begin some time this summer or early in the fall.

SALTILLO, MEX.—The new electric light and power plant of this city will be ready, it is stated, in August next. The plant will be a model in every respect and fitted up with new machinery, recently imported from Germany. The machinery represents an expenditure of $150,000, the company being capitalized at $200,000.

NORFOLK, VA.—In the Federal Court an order signed by Judge Waddill has been recorded authorizing the receivers of the Public Service Corporation of Virginia, at Hampton, to contract with the town officials of Phœbus to furnish twenty-one lights at a price of $30 per annum each. The contract will be for two years, subject to renewal for three years additional at the same price.

WASHINGTON, D. C.—The Potomac Electric Power Company has sold to Brown Brothers & Company, of New York, $650,000 consolidated mortgage 5 per cent bonds. The authorized amount of this issue is $7,000,000, of which $2,700,000 is now outstanding, $1,700,000 is held to retire a like amount of first mortgage bonds due in June, 1921, and the remainder, $2,600,000, is in the treasury of the company to be issued from time to time to pay for extension, betterments and improvements.

CHICAGO, ILL.—The Commonwealth Edison Company will make a general reduction in its rates for electricity August 1. The company has shown a large increase in business since the first of the year. Its contracts with the street-car companies, while the largest individual transactions, are not larger in the aggregate than the volume of smaller ones that have been obtained in the last six months. The company has more ready money on hand than at any previous time. No fresh funds will be required for new construction or further improvements this year. Sometime early in 1909, however, new securities probably will be sold. These will undoubtedly be the five per cent general mortgage bonds of the Commonwealth Electric Company. At the same time it is likely that the directors may arrange a new mortgage, and all of the underlying bonds will be refunded.

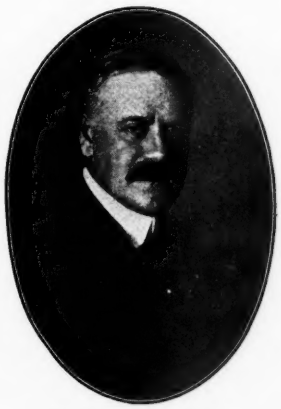
PERSONAL MENTION.

MR. ABNER COLEMAN has been reappointed manager of the municipal electric light plant of Taunton, Mass., for a period of three years from July 1. Mr. Coleman has held this position since 1891.

MR. FRANK HEDLEY, general manager of the Interborough Rapid Transit Company, has been elected a vice-president of the company. His title hereafter will be vice-president and general manager.

MR. GEORGE LORING, who has been connected for some time with the engineering department of the National Electric Association, became identified, on July 1, with the sales department of the Shelby Electric Company, of Shelby, Ohio. Mr. Loring was connected with this company in various sales capacities for eight years previous to going with the National Electric Lamp Association. Mr. Loring will devote a great deal of his time to pushing tungsten lamp sales, as the Shelby Company will be very active in the production of this type of incandescent lamp. For several years Mr. Loring has been a prominent figure at state and national electrical conventions and has contributed a number of important papers on the subject of incandescent lamps and illumination. His extensive experience, wide acquaintance and demonstrated ability make him a strong factor in the Shelby sales organization.

MR. LOUIS A. FERGUSON, who now takes up the duties of president of the American Institute of Electrical Engineers, was born in Dorchester, Mass., August 19, 1867. He was educated in the Boston public schools and graduated from the Dorchester High School in 1884. Entering the Massachusetts Institute of Technology he graduated in 1888 with the degree of bachelor of science in the electrical engineering department. Shortly after his graduation he began his association with the Chicago Edison Company in the underground department. In 1889 he was made assistant electrical engineer of the construction department, and in 1890 was appointed electrical engineer. So successful was his work in the engineering and operating departments, and so excellent his carrying out of those problems which involved commercial considerations, that in 1893 his duties were enlarged to cover the entire supervision of the company's contract business, in addition to his engineering work. In this field he was particularly successful, negotiating a number of valuable long-term contracts with some of the largest mercantile institutions in Chicago. On June 1, 1897, he was appointed general superintendent of the company, in charge of operating and electrical engineering departments as well as the central station and isolated-plant business. A year later he was appointed general superintendent of the Commonwealth Electric Company. On July 9, 1902, the directors of the Chicago Edison Company and of the Commonwealth Electric Company elected him second vice-president of both companies. This position he holds at the present time. He was elected president of the Association of Edison Illuminating Companies for the year 1901-1902, and re-elected to the same position for the year 1902-1903. He was elected president of the National Electric Light Association for the year 1902-1903, and he is now a member of the executive committees of both associations. Mr. Ferguson is credited with being the first engineer in this country to recommend a central station system generating three-phase alternating current with transmission lines to substations operating rotaries converting from alternating to direct current for general distribution. He has been prominently before the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies and the National Electric Light Association as an exponent of the most progressive ideas in electrical development. His literary contributions form some of the most classical reading which is available in the electrical field. He is a member of the Commercial Club of Chicago, the University Club, the Union League Club, Chicago Athletic Club, Mid-Day Club, Evanston Country Club, and the Onwentsia and Glen View Golf clubs. He has always been interested in public-spirited work in Chicago, and, in connection with this, served three years on the executive committee of the Merchants' Club.



MR. LOUIS A. FERGUSON.

ELECTRICAL SECURITIES.

So far as the stock market is concerned, there is little to chronicle of the doings of the short week ended Friday, July 3. The apathy which set in several weeks ago continued with the dulness intensified. Notwithstanding this, the indications still hold good that each day brings a brightening prospect. Idle freight cars are decreasing, and reports come in of new life in repair shops and rolling mills. The crop outlook is very encouraging, and labor more efficient than for many a day. It appears that there are few large accumulations of commodities to be disposed of, and that of necessity the recovery will be rapid and well sustained.

Dividends have been declared upon the following electrical securities: National Light, Heat and Power Company, regular quarterly dividend of 1¼ per cent on the preferred stock, payable July 1. Manchester Traction, Light and Power Company; regular quarterly dividend of 2 per cent, payable July 15 to stock of record July 1. Scranton Electric Company; quarterly dividend of 1½ per cent on the preferred stock, payable July 1. Philadelphia City Passenger Company; a semi-annual dividend of $3.75 per share, payable July 10 to stock of record June 29. Butte Electric and Power Company; a dividend of 1½ per cent on the common stock, payable July 6 to stock of record June 30. The common dividend was passed last December, previous to which time the rate was 1¼ per cent. The directors of the Electric Company of America have declared the regular semi-annual dividend of 3½ per cent to stock of record July 10. Books close July 10 and reopen August 4.

ELECTRICAL SECURITIES FOR THE WEEK ENDED JULY 4.

New York:	*Closing.*
Allis-Chalmers common	11½
Allis-Chalmers preferred	35½
Brooklyn Rapid Transit	48
Consolidated Gas	125½
General Electric	—
Interborough-Metropolitan common	11¾
Interborough-Metropolitan preferred	30⅝
Kings County Electric	115
Mackay Companies (Postal Telegraph and Cables) common	64
Mackay Companies (Postal Telegraph and Cables) preferred	64¼
Manhattan Elevated	134
Metropolitan Street Railway	23
New York & New Jersey Telephone	100
Western Union	55
Westinghouse Manufacturing Company	53¾

Boston:	*Closing.*
American Telephone and Telegraph	115
Edison Electric Illuminating	208
Massachusetts Electric	46½
New England Telephone	112
Western Telephone and Telegraph preferred	65

Philadelphia:	*Closing.*
Electric Company of America	10½
Electric Storage Battery common	30
Electric Storage Battery preferred	30
Philadelphia Electric	9¼
Philadelphia Rapid Transit	17⅛
United Gas Improvement	85¼

It is estimated that the gross earnings of the Philadelphia Rapid Transit Company, in the fiscal year ended June 30, 1908, were $18,400,000, an increase of about $300,000.

Chicago.	*Closing.*
Chicago Telephone	135
Commonwealth Edison	100¼
Metropolitan Elevated preferred	49¾
National Carbon common	69
National Carbon preferred	111

The daily average number of passengers carried on the elevated railroads during June was as follows: Metropolitan Elevated, 144,361; decrease, 4,167. South Side Elevated, 125,876; increase, 10,190. Northwestern Elevated, 109,107; increase, 10,056.

OBITUARY NOTE.

MR. GEORGE H. DANIELS, for many years prominently identified with the New York Central & Hudson River Railroad, died at Lake Placid, N. Y., on July 1. Mr. Daniels had been ill for some time, and his death was expected for several days. He was suffering from hardening of the arteries, with other complications. Mr. Daniels was born on a farm at Hampshire, Ill., in 1842. Like many other railroad men, he began at the foot of the ladder, starting in at the age of fifteen as a rodman in the engineering corps of the North Missouri Railroad. His advance was rapid, and in 1872 he was made general freight and passenger agent of the Chicago & Pacific Railroad. He served in various offices, notably as commissioner of the Central Traffic Association, and in 1889 was made general passenger agent of the New York Central & Hudson River Railroad. He became conspicuous in this position for his advertising ability, the name "Empire State Express" being one of his inventions. It is said that during Mr. Daniels' service as general passenger agent the New York Central lines were the best and most widely advertised in the world. In 1905 Mr. Daniels was appointed international advertising manager of the New York Central lines, serving in that office until his retirement. The death of Mr. Daniels comes as a personal loss to a host of men prominent in every walk of life. No one could come in contact with him without being impressed with his great personality, and the regard in which he was held amounted in many instances to the sincerest affection. Not only did he endear himself to many, but he served the country in a noteworthy manner. The Adirondacks, the Hudson River, the Thousand Islands, Niagara Falls and other beauty spots of the United States became familiar points of interest and were impressed upon the public mind in such indelible fashion through his efforts that it might truly be said that, having done his work so well, the necessity does not remain for any one to take his place.

MR. GEORGE H. DANIELS.

NEW INCORPORATIONS.

COLUMBUS, OHIO—Cadiz Electric Company, Cadiz. Capital stock increased from $12,000 to $60,000.

SALEM, ORE.—Mollalla Power Company, Canby. $10,000. Incorporators: John B. Hurst, W. S. Hurst and Fred P. Hurst.

AUSTIN, TEX.—Cisco Light and Power Company, of Cisco. $16,000. Incorporators: G. W. Troxwell, W. C. Bedford and C. H. Free.

AUSTIN, TEX.—Luzon Telephone Company, of Clairemont, Kent County. $25,000. Incorporators: S. A. McCombs, T. G. Harkey and J. M. Kelley.

RALEIGH, N. C.—Suburban Land and Power Company. To operate railways and electric power plants, distribute electricity and gas, and engage in other business. $40,000. Incorporators: E. J. Parrish, J. M. Gregory, John Sprunt Hill, W. W. White, R. W. Winston.

SALT LAKE CITY, UTAH.—Electric Supply and Fixture Company. $20,000. Officers and directors: R. W. Nichol, president; A. T. Wright, vice-president; D. C. Eccles, treasurer; C. J. Humphris, secretary; A. E. Lawrence, director. To generate electricity and establish electric distributing systems.

JERSEY CITY, N. J.—Charlotte Power Company. Formed to manufacture and operate street and railway cars, evidently in Charlotte, N. C. $300,000 in $100 shares. Incorporators: Oscar L. Wold, Wade M. Adams and T. C. Raine. Southern Construction Company, allied with the above with $100,000 in $100 shares.

ELECTRIC RAILWAYS.

DANVILLE, PA.—The Sunbury & Selinsgrove Electric Railway has been completed and placed in operation.

DAYTON, OHIO—The Circuit Court has upheld the validity of the fifty-year franchise of the Oakwood Street Railway Company, which had been attacked by the municipality.

STEUBENVILLE, OHIO—The new $7,000,000 Ohio River Passenger Electric Railway Company's "Ohio River Scenic Route" from Vanport to Steubenville, Ohio, was thrown open to the public on June 28.

GRAND JUNCTION, COL.—The city council has granted to H. E. Devereaux, of Colorado Springs, a franchise to build a street railway in Grand Junction. Work will begin July 15 and cars must be operated on three miles of track within one year.

KANSAS CITY, MO.—The contract for the Oregon interurban railway to be built from the Burlington tracks to Oregon, Mo., has been let. The contract calls for the road to be completed with all equipments, switches and bridges, less terminal and rolling stock, within 100 days.

BISMARCK, MO.—A party of St. Louis capitalists and the Business Men's Club of Irondale have completed the preliminary arrangements for an electric railroad to extend from Belgrade, in Washington County, to Perryville, in Perry County. A dam across Big River, near Irondale, will furnish the motive power.

McKINNEY, TEX.—At a meeting of the citizens of this place, Bonham, Blue Ridge and other points, W. S. Cole, of Detroit, Mich., representing Eastern capitalists, presented a proposition for the construction of an electric railway between Fort Worth and Bonham. The proposition was accepted and an organization of the stockholders effected, with J. L. Lovejoy as chairman.

UTICA, N. Y.—The Public Service Commission has authorized the Dolgeville & Salisbury Railway Company to increase its capital stock from $100,000 to $150,000 and to issue $150,000 common capital stock. The capital stock is to be issued at not less than the par value, the proceeds to be used for building the railway between Dolgeville and the Salisbury Steel and Iron Company's plant, a distance of about four miles.

BUFFALO, N. Y.—E. H. Rogers, a wealthy Tonawanda contractor, and a number of other capitalists are understood to be organizing a company to build an eight-mile trolley line over private right of way from O'Neill street down the river front to Tonawanda, passing close to the new Wickwire Steel Plant and being partially designed to give transportation facilities to and from that plant, which is to employ upward of 500 men.

MANSFIELD, OHIO—The stockholders of the Mansfield Street Railway, Light and Power Company at their annual meeting elected the following board of directors: S. N. Ford, Mansfield; F. E. Myers, Ashland; J. A. Rutherford, F. L. Fuller and E. F. Snyder, Cleveland; T. H. Creden, Chicago; Charles W. Dupuis, Cincinnati. The board organized by electing S. N. Ford, of Mansfield, president; F. L. Fuller, of Cleveland, vice-president, and Sidney A. Foltz, of Mansfield, secretary and treasurer. Mr. Foltz was also chosen manager.

ROCHESTER, N. Y.—The Rochester, Scottsville & Caledonia Electric Railway Company, which was incorporated to build a line from Rochester to Caledonia, has decided to branch out in several directions as well as carrying the line on through to Portage, a distance of fifty-five miles, following the Genesee Valley and skirting the shores of Silver Lake. The line will cross the river between West Henrietta and Scottsville, thence will run southwesterly to Garbutt, Wheatland, Mumford and the State Fish Hatchery, thence to Caledonia, to the salt mines of Retsof and Greigsville, touching at Le Roy and passing through the Oatka Valley to Pavilion; then across Pear Creek, through La Grange and Perry Center to Perry, Silver Lake, Castile and Portage. The president of the company is David C. Salyerds, and the local incorporators are Henry C. Brewster, George C. Buell, Charles P. Ford, Charles T. Chapin, Andrew H. Brown, Isaac W. Salyerds and Edmund Lyon. The line will be known as the Scenic Route. The total cost of its construction from Rochester to Portage is estimated at $2,135,000.

TELEPHONE AND TELEGRAPH.

MARSHALL, MICH.—Improvements costing about $1,000 have been made to the local exchange of the Citizens' Telephone Company.

READING, PA.—The American Union Telephone Company has increased to a considerable extent its trunk line facilities in this section of the state.

WILMINGTON, DEL.—The Delaware & Atlantic Telegraph and Telephone Company will remove all poles within the city where possible and place its wires underground.

JOPLIN, MO.—Work has been begun on the foundation for the new Bell Telephone building, which is estimated to cost $250,000. It will be forty-six by seventy-five feet in area and three stories in height, and is expected to be completed in October.

STEPHENS, ARK.—A new telephone company composed of local citizens has been organized here and application has been made to the city council for a franchise. There are nearly 200 members of the new company and they propose to begin work early in July.

SAN MARCIAL, N. M.—T. J. Mathews is authority for the statement that the Socorro County Telephone Company, of which he is manager, will extend its system as far as the Elephant Butte dam this year, and as soon as possible connections will be made to El Paso.

NEW YORK, N. Y.—The New York & New Jersey Telephone Company announces a change of rate affecting telephone subscribers in the Coney Island, Bath Beach, Astoria and Long Island City sections. Brooklyn Borough, Astoria and Long Island City, in the Borough of Queens, are considered one local service area. The company also announces that rates for messages from public telephones in Bath Beach and Coney Island are reduced to five cents to Brooklyn, and ten cents, instead of fifteen cents, to Manhattan. The change is in effect.

INDUSTRIAL ITEMS.

THE LINCOLN MOTOR WORKS COMPANY, Caxton Building, Cleveland, Ohio, has ready for distribution a new bulletin devoted to type A Lincoln variable-speed motors.

THE NORTON COMPANY, Worcester, Mass., has published a very interesting booklet giving a great deal of information concerning the use of grinding and abrading wheels.

THE BRISTOL COMPANY, Waterbury, Ct., has issued bulletin No. 92, devoted to Bristol's recording thermometer, Class II, for temperatures between forty degrees and 500 degrees Fahrenheit.

THE NORTHERN ELECTRICAL MANUFACTURING COMPANY, Madison, Wis., will be pleased to send to any one interested upon request, a new bulletin descriptive of type B direct-current motors and generators.

THE AMERICAN STEEL AND WIRE COMPANY, The Rookery, Chicago, Ill., has published a great deal of information of value and interest concerning steel wires and ropes in the "American Wire Rope News" for May.

THE HOLTZER-CABOT ELECTRIC COMPANY, Brookline, Boston, Mass., has ready for distribution bulletins Nos. 307B, 314A and 316, descriptive, respectively, of buffing and grinding motors for direct and alternating current, type "C" motors and dynamos for direct current, and type "LM" motors for direct current.

THE FOSTORIA GLASS SPECIALTY COMPANY, Fostoria, Ohio, his issued a blotter enclosed in a folder representing a giant firecracker. In connection with the July holiday spirit the company states that the central station manager can announce a declaration of independence and celebrate this day of days by declaring for "Noblac" inner globes.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Ct., in the July issue of "Trumbull Cheer" calls attention to its type C switches. These are made with and without fuses in all capacities for 250 and 500 volts. A supplement to this issue of "Trumbull Cheer" shows a sixty-foot switchboard made up of thirty panels, built by the Trumbull Electric Manufacturing Company.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has issued a new catalogue, No. H1a, devoted to battery charging rheostats for electric automobiles, for private plants and garage duty; also rheostats to take care of the discharge of storage cells, and a complete line of charging rheostats for ignition cells and portable batteries. Copies of the catalogue will be furnished to those interested upon request.

W. N. MATTHEWS & BROTHER, 227 North Sixth street, St. Louis, Mo., are the exclusive sales agents of an improved form of incandescent lamp changer. By means of this apparatus the operator can replace incandescent lamps in lofty or almost inaccessible places. The company suggests the advantage of central station companies making use of this lamp changer in facilitating the replacing of burned-out lamps by their customers.

THE GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has issued a comprehensive bulletin, No. 4,593, devoted to the subject of "Railway Converter Substations." This publication gives a general description of the various pieces of substation apparatus and includes illustrations of converter stations operated by well-known railway companies. Another bulletin, No. 4,590, is devoted to automatic compensating devices for alternating-current motors.

THE PRATT & WHITNEY COMPANY, Hartford, Ct., has issued a handsome catalogue devoted to the Spline milling machine. This is an absolutely new tool embodying new principles and taking care of work for which heretofore there has been no suitable machinery. By its use the designer is enabled to take advantage of the use of slots, which many times simplify the design, but which, heretofore, have been avoided owing to the high manufacturing cost. The aim in bringing out the new tool has been to produce a machine specially built for slot milling, particularly slots with closed ends.

THE F. BISSELL COMPANY, 226-230 Huron street, Toledo, Ohio, has ready for distribution a list of second-hand machinery. This is entitled "The Little Book of Real Bargains." While this department of the Bissell Company's business has been in existence for a good many years, it was not until the last year that it entered into the second-hand machinery business on a large scale. A good deal of the success of this department can be attributed to the fact that the company buys or trades as well as sells apparatus. The Bissell Company will be pleased to place the name of any one interested on its mailing list for this booklet of bargains.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing new catalogues on malleable-iron specialties, such as anchors, feeder arms, pins, cross-arms, bolts, wall brackets, spreader brackets, strain plates, strain insulators, corner brackets, catenary hangers, etc. The catalogue includes the report of tests made by Columbia University, New York city, on the malleable-iron cross-arm bolt, these tests being made to ascertain the load required to strip or destroy the bolt threads. The catalogue contains about forty pages, and will be found of interest to consulting engineers and station managers. Copies will be furnished upon request.

THE CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., makers of electric controlling devices, has completed arrangements whereby it will be represented on the Pacific Coast by Otis & Squires, of 111 New Montgomery street, San Francisco, Cal. A large stock of standard Cutler-Hammer controllers will be carried by Otis & Squires, enabling them to make prompt delivery of apparatus. A. W. Vinson, who has for several years been connected with the engineering department of the Cutler-Hammer Manufacturing Company, has been transferred to the office of Otis & Squires, where his services will be available to those confronted with problems of electrical control which can not be met by the use of standard apparatus.

W. R. BRIXEY, manufacturer of the well-known "Kerite" wires and cables, has moved to larger and more commodious offices on the nineteenth floor of the Cortlandt Building of the Hudson Terminal, 30 Church street, New York city. Probably no pleasanter offices in this line are to be found in the city, as they overlook the Hudson River and are airy and large. R. D. Brixey, son of W. R. Brixey, is in charge of the affairs of the company. A large branch office has been established in the Railway Exchange Building, Chicago, Ill., under the direction of the company's representative, the Watson Insulated Wire Company. One of the conspicuous features of the New York office is a large and very perfect rubber biscuit, said to be the finest ever imported to this country, which came from Brazil, and is on exhibition in the ante-room, containing probably $1,000 worth of pure Para rubber.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Cosmos Club, Washington, D. C.

AMERICAN ELECTROTHERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, 352 Willis avenue, New York city.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa. Fall meeting, New York city, October 30-31.

AMERICAN FOUNDRYMEN'S ASSOCIATION. Secretary, Dr. Richard Moldenke, Watchung, N. J.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth street, New York City. Meetings, second Friday of each month.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION. Secretary, J. W. Taylor, Old Colony Building, Chicago, Ill.

AMERICAN ROENTGEN RAY SOCIETY. Secretary, Dr. G. C. Johnson, 514 Bijou Building, Pittsburg, Pa.

AMERICAN SOCIETY FOR TESTING MATERIALS. Secretary, Professor Edgar Marburg, University of Pennsylvania, Philadelphia, Pa.

AMERICAN SOCIETY OF CIVIL ENGINEERS. Secretary, Charles Warren Hunt, 220 West Fifty-seventh street, New York city.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Secretary, Calvin W. Rice, 29 West Thirty-ninth street, New York city.

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS. Secretary, G. W. Tillson, Park Row Building, New York city. Annual meeting, Atlantic City, N. J., October.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Annual convention, Atlantic City, N. J., October 12-16.

AMERICAN STREET AND INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, Elmer M. White, treasurer Birmingham Railway, Light and Power Company, Birmingham, Ala. Annual convention, Atlantic City, N. J., October 12-16.

AMERICAN STREET AND INTERURBAN RAILWAY CLAIM AGENTS' ASSOCIATION. Secretary, B. B. Davis, claim agent Columbus Railway and Light Company, Columbus, Ohio. Annual convention, Atlantic City, N. J., October 12-16.

AMERICAN STREET AND INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, J. W. Corning, electrical engineer Boston Elevated Railway Company, Boston, Mass. Annual convention, Atlantic City, N. J., October 12-16.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION. Secretary, George B. Keegan, 2321 Park Row Building, New York city. Annual convention, Atlantic City, N. J., October 12-16.

ARKANSAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. W. Freeman, vice-president and general manager Edison Electric Illuminating Company, Brooklyn, N. Y.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, Welles E. Holmes, 308 Washington street, Newton, Mass.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis.

CALIFORNIA ELECTRIC RAILWAY ASSOCIATION. Secretary, L. E. W. Pioda, Oak and Broderick streets, San Francisco, Cal.

CALIFORNIA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, P. T. Whittier, Spencer, Cal.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, Toronto, Canada.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Acton Burrows, 33 Melinda street, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, W. F. Milholland, secretary and treasurer Indianapolis Traction and Terminal Company, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. F. Dostal, Denver, Col. Annual convention, Glenwood Springs, Col., September 16-18.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Ct.

ELECTRIC CLUB OF CLEVELAND. Secretary, George L. Crosby, 1200 Schofield Building, Cleveland, Ohio.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, John P. Faure, 77 Water street, Ossining, N. Y.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine street, St. Louis, Mo.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederic P. Vose, Marquette Building, Chicago.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA, LIMITED. Secretary, William R. Stanley, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckels Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York city. Board of directors meets second Friday of each month.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau street, New York city.

ENGINEERS' CLUB OF PHILADELPHIA. Secretary, H. G. Perring, 1317 Spruce street, Philadelphia, Pa.

ENGINE BUILDERS' ASSOCIATION OF THE UNITED STATES. Secretary, J. I. Lyle, 39 Cortlandt street, New York city.

ILLINOIS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. A. Camp, Henry, Ill.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, La Salle, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, Van Rensselaer Lansingh, Engineering Societies Building, 33 West Thirty-ninth street, New York city. Annual convention, Philadelphia, Pa., October 6-7.

INDEPENDENT TELEPHONE ASSOCIATION OF TEXAS AND LOUISIANA. Secretary, C. A. Shock, Sherman, Tex.

INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. S. Norton, Indianapolis, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Annual meeting, Detroit, Mich., August 19-21.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ward, Grand Rapids, Mich.; assistant secretary, J. A. Harney, Monadnock Building, Chicago, Ill.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary C. C. Deering, Boone, Iowa.

IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

KANSAS GAS, WATER, ELECTRIC LIGHT AND STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

MAINE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, M. E. Crow, Houlton, Me.

MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress street, Portland, Me.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby street, Boston, Mass. Meets second Wednesday of each month, except July and August.

MASTER CAR BUILDERS' ASSOCIATION. Secretary, J. W. Taylor, 390 Old Colony Building, Chicago, Ill.

MICHIGAN ELECTRIC ASSOCIATION. Secretary, A. C. Marshal, Port Huron, Mich. Annual meeting, Grand Rapids, Mich., August 18-21.

MICHIGAN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. A. Burch, Battle Creek, Mich.

MISSOURI ELECTRIC LIGHT, GAS AND STREET RAILWAY ASSOCIATION. Secretary, Claude L. Clary, Sikeston Electric Light and Power Company, Sikeston, Mo.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, George W. Schweer, Windsor, Mo.

NATIONAL ARM, PIN AND BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 94 Genesee street, Utica, N. Y. Next meeting, Chicago, Ill., July 15-17.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, Commonwealth Edison Company, Chicago, Ill.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln.

NEBRASKA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. E. Mattison, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 60 State street, Boston, Mass.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl street, Boston, Mass. Meetings held on fourth Thursday of every month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. Max Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, R. N. Kimball, Kenosha, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Annual convention, Put-in-Bay, Ohio, August 25-27.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Ballard, Cleveland, Ohio.

OHIO STREET RAILWAY ASSOCIATION. Secretary, Charles Currie, Akron, Ohio.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. C. B. Roulet, Mercury, Dallas, Tex.

PACIFIC COAST ELECTRIC TRANSMISSION ASSOCIATION. Secretary, Samuel G. Reed, Portland, Ore.

PENNSYLVANIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, H. E. Bradley, 135 South Second street, Philadelphia.

PENNSYLVANIA STATE STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Lebanon, Pa.

PIKES PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL AND GAS ASSOCIATION. Secretary, J. A. Myler.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, J. G. White & Company, New York, N. Y.

TEXAS INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Charles F. Speed, Texarkana, Tex.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby street, Boston, Mass.

VERMONT AND NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary-treasurer, G. W. Buzzell, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

VIRGINIA STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, B. L. Fisher, Rocky Mount, Va.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W S. Boyd, 382 Ohio street, Chicago, Ill.

WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

DATES AHEAD.

National Electrical Contractors' Association. Next meeting, Chicago, Ill., July 15-17.

Michigan Electric Association. Annual meeting, Grand Rapids, Mich., August 18-21.

International Association of Municipal Electricians. Annual convention, Detroit, Mich., August 19-21.

Ohio Electric Light Association. Annual convention, Put-in-Bay, Ohio, August 25-27.

Colorado Electric Light, Power and Railway Association, Glenwood Springs, Col., September 16-18.

American Society of Municipal Improvements. Annual meeting, Atlantic City, N. J., October.

Illuminating Engineering Society. Annual convention, Philadelphia, Pa., October 6-7.

American Street and Interurban Railway Association. Annual convention, Atlantic City, N. J., October 12-16.

American Street and Interurban Railway Accountants' Association. Annual convention, Atlantic City, N. J., October 12-16.

American Street and Interurban Railway Claim Agents' Association. Annual convention, Atlantic City, N. J., October 12-16.

American Street and Interurban Railway Engineering Association. Annual convention, Atlantic City, N. J., October 12-16.

American Street and Interurban Railway Manufacturers' Association. Annual convention, Atlantic City, N. J., October 12-16.

American Electrochemical Society. Fall meeting, New York city, October 30-31.

Record of Electrical Patents.

Week of June 30.

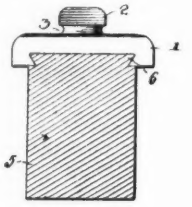
891,825. ELECTRIC-WIRE SPLICER. Conrad J. Dorff, Chicago, Ill. A connector formed of a strip of metal with beveled edges reversely bent to form four parallel tubes.

891,833. OIL-SWITCH. Edward M. Gerry, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. The resistance units and contact segments are submerged in a tank of oil.

891,847. DYNAMO-ELECTRIC MACHINE. Emil Mattman, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Means are provided for supporting the cross-connectors between the brush-holders, and independent means for locking the brush-holders.

891,906. ARMATURE CORE. John F. Card, Three Rivers, Mich., assignor to the Sheffield Car Company, Three Rivers, Mich. The core discs have registering openings arranged in series and with radial projections forming channels to receive the armature coils.

891,948. ELECTRIC FIRE ALARM AND THERMO-INDICATOR. Alfred H. McNeil, Highams Park, England. The thermostat arms move plungers and close the alarm circuit.



891,955.—INSULATOR.

891,955. INSULATOR. William C. Sandlin, Andrews, N. C., assignor of one-third to Arthur Moulton and one-third to C. W. Savage. A dovetailed insulator for slipping over a cross-arm.

891,961. TELEPHONE-CONTROLLING DEVICE. Nathan Silverson, New York, N. Y. The contact lever is released by the swinging movement of a second arm.

891,982. ELECTROLYTIC PROCESS FOR THE PRODUCTION OF METALLIC DARK COATINGS UPON METALS. Alexander Classen, Aachen, Germany. After a deposit of sufficient thickness has been obtained the applied potential is lowered.

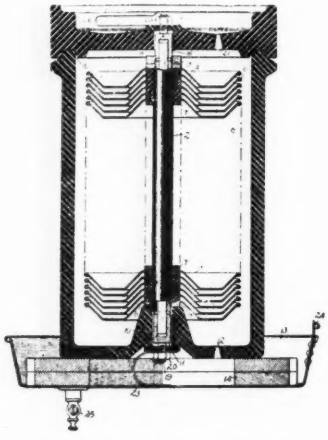
891,995. ELECTROLYTIC CELL. Ralph B. Ingram, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. A cell built up of a plurality of similar frustro conical plates.

892,016. TROLLEY WHEEL. Robert P. Stark and Charles R. Klingensmith, Creighton, Pa. A wheel with a rectangular bushing.

892,065. ELECTROMAGNET. David L. Lindquist, Yonkers, N. Y. An alternating-current magnet with means for absorbing vibration.

892,167. MOUNTING FOR ELECTRICAL APPARATUS. Malcolm E. Launbranch, Chicago, Ill., assignor to Western Electric Company, Chicago, Ill. A case for holding a telephone set.

892,177. ELECTRIC ILLUMINATOR. Henry J. Mullen, Burlington, Vt. A distributor for electric signs.



891,995.—ELECTROLYTIC CELL.

892,188. PROCESS FOR SEPARATING AND SIMULTANEOUSLY EXTRACTING WATER FROM MINERAL, VEGETABLE AND ANIMAL SUBSTANCES. Botho Schwerin, Frankfort-on-the-Main, Germany, assignor to Farbwerke vorm. Meister Lucius & Brüning, Höchst-on-the-Main, Germany. An electric current is passed through the cells so as to set up electro-osmosis.

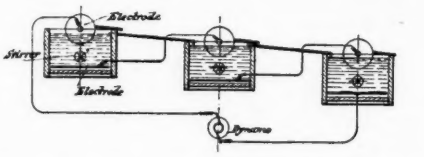
892,203. SIGNALING SYSTEM FOR RAILROADS. Max W. Zabel, Chicago, Ill. A system employing currents of different electrical character for the different signals.

892,204. RAILWAY SIGNALING APPARATUS. Max W. Zabel, Chicago, Ill. The signals are responsive to electric currents of different character.

892,211. PROCESS OF PRODUCING LOW-CARBON ALLOYS. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Company. A mixture of a refractory metal and a reducing agent is smelted in an electric furnace.

892,212. ELECTRIC-FURNACE METHOD. Frederick M. Becket, Niagara Falls, N. Y., assignor to Electro Metallurgical Company. A heat-retaining crust of the solidified constituents of the bath is maintained over the surface.

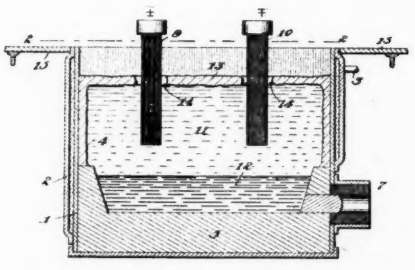
892,272. TROLLEY GUARD AND GUIDE. Charles Latsch, Cleveland, Ohio, assignor of twenty-four one-hundredths to C. A. Mueller and twenty-four one-hundredths to Jos. H. Wenneman, Cleveland, Ohio. Spring-mounted wire guards project above the wheel.



892,188.—PROCESS FOR SEPARATING AND SIMULTANEOUSLY EXTRACTING WATER FROM MINERAL, VEGETABLE AND ANIMAL SUBSTANCES.

892,311. APPARATUS FOR PLOTTING RESONANCE CURVES. Otto Scheller, Steglitz, near Berlin, Germany. A variable inductance and a variable capacity are mounted so as to be simultaneously adjustable.

892,312. SYSTEM FOR RECEIVING UNDAMPED ELECTRIC OSCILLATIONS. Otto Scheller, Steglitz, near Berlin, Germany. A system utilizing the combination of a high-frequency and a low-frequency circuit.

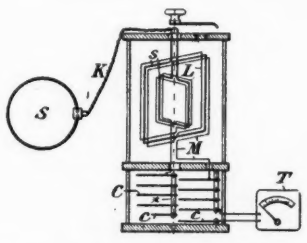


892,212.—ELECTRIC-FURNACE METHOD.

892,319. BINDING POST. Nicholas Sohl, New York, N. Y., assignor to W. R. Ostrander & Company. A spring clip.

892,332. ELECTRICAL INCANDESCENT LAMP. Orlando M. Thowless, Newark, N. J. A non-refractory core is coated with a thin shell of ductile metallic tantalum, producing a filament of high resistance.

892,355. TROLLEY WHEEL. George C. Bourdereaux, Peoria Ill., assignor, by direct and mesne assignments, to Melvin W. Swartz, Peoria, Ill. A wheel with recessed sides.



892,311.—APPARATUS FOR PLOTTING RESONANCE CURVES.

892,359. ELECTRIC-RAILWAY SIGNALING SYSTEM. Yorke Burgess, Washington, D. C., assignor, by mesne assignments, to American Signal Company, Kansas City, Mo. An electromagnetic system for producing signals on trains.

892,371. TROLLEY EAR. Charles W. Eliot, Tampa, Fla., assignor of one-half to William H. Caldwell, Tampa, Fla. A pin is provided for locking the ear boss and the shank.

892,375. ELECTRIC SOCKET SWITCH. Harvey Hubbell, Bridgeport, Ct., assignor to Harvey Hubbell, Incorporated, Bridgeport, Ct. A switch formed of a contact bar and a contact plate, one of the parts being provided with alternate projections and depressions.